# ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

## Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 14, No. 9. WEEKLY. NEW YORK, SATURDAY, APRIL 27, 1889. $3 per annum. Single Copies, 10 Cents.



Copyright, 1889, by ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York.



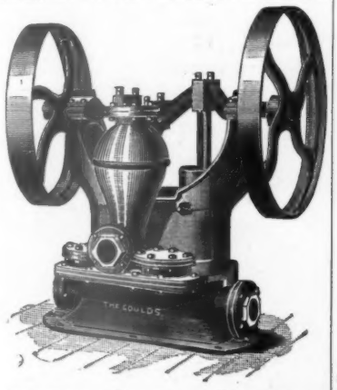
Entered at Post Office, New York, as Mail Matter of the Second Class.


### Seeking Revenge Upon a Telephone Company.

A few days ago Superintendent Hanchett of the Central New York Telephone Company discontinued the telephone office at East Rodman, N. Y., in this county, because it did not pay, and the people of the place would not guarantee an income of $48 a year from the office. Some of the residents have taken offence at this action, and in revenge have repeatedly cut the company's wire that passes through that section. Repairers have been sent there each day to restore the wires, and each night the line has been broken again, the last time about 50 feet being taken away. Watchers have now been employed, and a reward offered for the detection of the vandals.

### Direct Triplex Suction and Force Pump.

The triple-acting power pumps of the Gould Manufacturing Company, of Seneca Falls, N. Y., are well known to a great many of our readers. The work of this company in this line has long been popular and reliable, and the fact will be read with interest that they are more fully developing their triplex system of pumps (one of which we illustrate on this page), and expect soon to make them adaptable for both hot and cold water. The illustration we present shows the pump with pulley and fly-wheel attached. This is a new design, and among the chief points claimed for it are simplicity, compactness, strength, ease and uniformity of operation, and accessibility of working parts. With a 36-inch pulley on the crank shaft it can be driven from pulley on countershaft with almost noiseless effect by high speed electric motors, gas or oil engines, and owing to plan of connecting plunger rods to crank, combined with large air chamber, there is no audible reaction of the water in pipes. Our electric power friends will find in this new work of the Gould Company a valuable co-worker in advancing the use of the electric motor.




NEW TRIPLE SUCTION AND FORCE PUMP.

### A Victory for the Western Union.

The suit of Frank J. Primrose to recover heavy damages from the Western Union Telegraph Company, arising from an excessive purchase of wool in June, 1887, owing to a mistake made by a receiving operator in a cipher message, ended in favor of the defendant in the United States Circuit Court, at Philadelphia, last week. Judge Butler dwelt at length upon the agreement printed on the back of the telegraph blanks, which stipulates that upon the payment of an extra charge of one-half of the price of sending a message it can be repeated and the danger of mistakes avoided. The extra payment was not made in this instance.

FIG. 1.—THE PERFECT FARADIC BATTERY.

### Improved Medical Batteries.

The John A. Barrett Battery Company, of Baltimore, Md., has recently brought out several new forms of medical batteries, the invention of that very capable and ingenious electrical worker, Mr. John A. Barrett, of New York. The REVIEW is pleased to be able to illustrate these valuable batteries, and to speak a word in their favor. Mr. Barrett is a conscientious and well-informed electrician, and the batteries, as coming from his hand, may be relied on to equal every promise or claim made by his company.

Fig. 1 is an elegantly finished, compact instrument, the metal parts of best material, carefully adjusted and handsomely nickel-plated. It has two hermetically sealed cells, either one or both of which can be used as required. It has a Du Bois Raymond system induction coil, with interchangeable fine and coarse wire winding for secondary current on the outer bobbin; wire horseshoe for bringing primary current into circuit; plain and interrupting handles with best quality sponge electrodes and conducting cords, etc., put up in hard wood box with self-locking handle, which securely fastens the box and lid, as soon as it is shut and attempt made to lift it. The cells of these batteries will work 100 hours continuously, and, it is estimated, will cost 1½ cents per hour to operate.

Fig. 2, the split top Faradic battery, is designed especially for physicians visiting use, and has several entirely new and novel features. It is put up in a handsomely finished hard-wood box, six inches high and about five inches square, with this company's automatic lock handle. The box top is split lengthwise, can be opened, as shown in the cut, when the handle is turned aside, but is always securely fastened and locked when lids are closed and handle raised in position to carry. This battery has a most powerful induction coil and a four-cell block giving a very steady and uniform current of three

FIG. 2.—THE SPLIT-TOP FARADIC BATTERY.

FIG. 3.—THE POCKET FARADIC BATTERY.

kinds—primary, secondary and combined—the force of which can be easily modified and made delicate enough for the most nervous or sufficiently strong for the most robust patient.

Shutting that part of box top which covers the coil throws the lever off the contact stud and stops the current automatically, thus providing against forgetfulness on part of operator and unnecessary wear of the elements.

The pocket Faradic battery is shown in Fig. 3. This instrument is designed for the use of families as well as physicians, and is extremely handy, compact, durable and simple in its mechanism. It is put up in a handsome hard-wood box, 8½ inches long and 4½ inches wide and two inches deep, and furnished with a pair of conducting cords, one pair ebonite handles and one pair hollow metal electrodes. The induction coil giving three currents—primary, secondary and combined—is of superior make and finish, and is remarkable for the uniformity and smoothness of its current.

### The Western Electric Incandescent Lighting System.

The Western Electric Company, of Chicago, New York, London and Antwerp, have introduced recently an incandescent lighting system of their own manufacture and design, which possesses new and interesting features.

The type of field magnet frame used in their well know arc lighting system is not used for incandescent lighting, but a simpler form and one better adapted to this class of work has been adopted.

Figs. 1 and 2 illustrate a complete dynamo; while Fig. 3 shows a field magnet and pole pieces only. The whole iron base is cast in one piece. The cores of the field magnets are made of soft iron, and pole pieces are cast upon the upper ends of the cores. The lower ends of the cores are bolted to the cast iron base. There are therefore only two magnetic joints in the whole system. The field magnet coils are connected shunting the armature. The automatic regulation thus secured is practically perfect. Any number of lamps may be cut in or out without visibly affecting the candle-power or brilliancy of the lamps throughout the system. The armature is of the drum type, and is wound in a very simple and peculiar way, avoiding all joints in the wires but two.

The electrical and commercial efficiency of the dynamo is very high, while in its mechanical construction it is above the average. There is a self-adjusting bearing on the pulley side.

The peculiar form of the cast iron base results in bringing the armature shaft at a convenient height from the floor, but not so high as is usually the case in dynamos having this type of field magnet, while at the same time it permits the use of the sliding carriage for adjusting belt tension without raising the dynamo or rendering it unstable.

On the top of the pole pieces is secured a hard wood board, on which the field and main binding posts are mounted.

The rheostat, Fig. 4, is non-combustible. It consists of a cast iron frame provided with porcelain insulators, to which the German silver wire coils are attached. The front of the rheostat box is covered with glass, preventing the dirt and dust from getting into the box, and at the same time allowing ready inspection.

Figs. 5 and 6 represent the volt and ammeters. The instruments are dead beat, and may be left in the circuit permanently without overheating.

The lightning arrester, Fig. 7, is very simple in its operation, and requires no automatic cut-outs or safety strips for the prevention of short circuits. The jaws of this lightning arrester are made of carbon plates. In case the dynamo current should follow a discharge of atmospheric electricity, an arc may be set up, but this will burn away some of the carbon points, and thus free the dynamo of the short circuit. Such a carbon lightning arrester can of course only be used for low tension dynamos.

Fig. 8 represents a main switch. Fig. 9, a multiple safety cut-out board. Figs. 10 and 11, ceiling cut-outs. Fig. 12, a branch block. These instruments are all mounted on wood or porcelain.

The multiple safety cut-out board is used where wires are run to central distributing points located in closets. All the safety devices are provided with glass covers to keep out the dust, and at the same time allow of ready inspection.

The whole system is carefully worked out to the smallest details, and the best experience has been brought to bear to construct the most perfect apparatus. See other cuts on page 9.

FIG. 3.—FIELD MAGNET AND POLE PIECES.

### New Storage Battery Cars in Philadelphia.

A new car called the "Edco," operated by the storage battery of the Electrical Accumulator Company, was successfully tried in Philadelphia last week. The *Ledger* publishes a lengthy account of the successful trial, and states that the car resembles in many respects that which made several trips in that city last year, but the machinery has been considerably modified. The experimental car used is a trifle heavier than that of the ordinary street car. The two electric motors, with the necessary gearing, weigh about a ton. The battery consists of 88 hard rubber cells, hermetically sealed, and is arranged under the seats of the car. It weighs one and a half tons. This supplies the current for two electric motors, each geared to a separate axle of the car. The motors are made to give 1,000 revolutions a minute, with the full power of the battery, but by the use of gear wheels this is reduced so as to run the car at the ordinary speed of eight to ten miles an hour. The commutator box is so arranged that all the cells may be put in "series" or into two "parallels" or into four "parallels," according to the character of the work to be done. The driver controls the application of the power by means of a wheel. Each of the motors will give 13 horse power when the full force of the battery is applied, and this is ample for any work which they may be called upon to do. The company claim that sufficient energy is contained in the 88 cells to run the cars 60 miles, under ordinary conditions.

FIG. 5.

—— The city aldermen of London, Canada, have practically decided to adopt an arc electric light system in preference to an incandescent one, and the fight for the contract will be between the Ball and the Western Electric Companies.

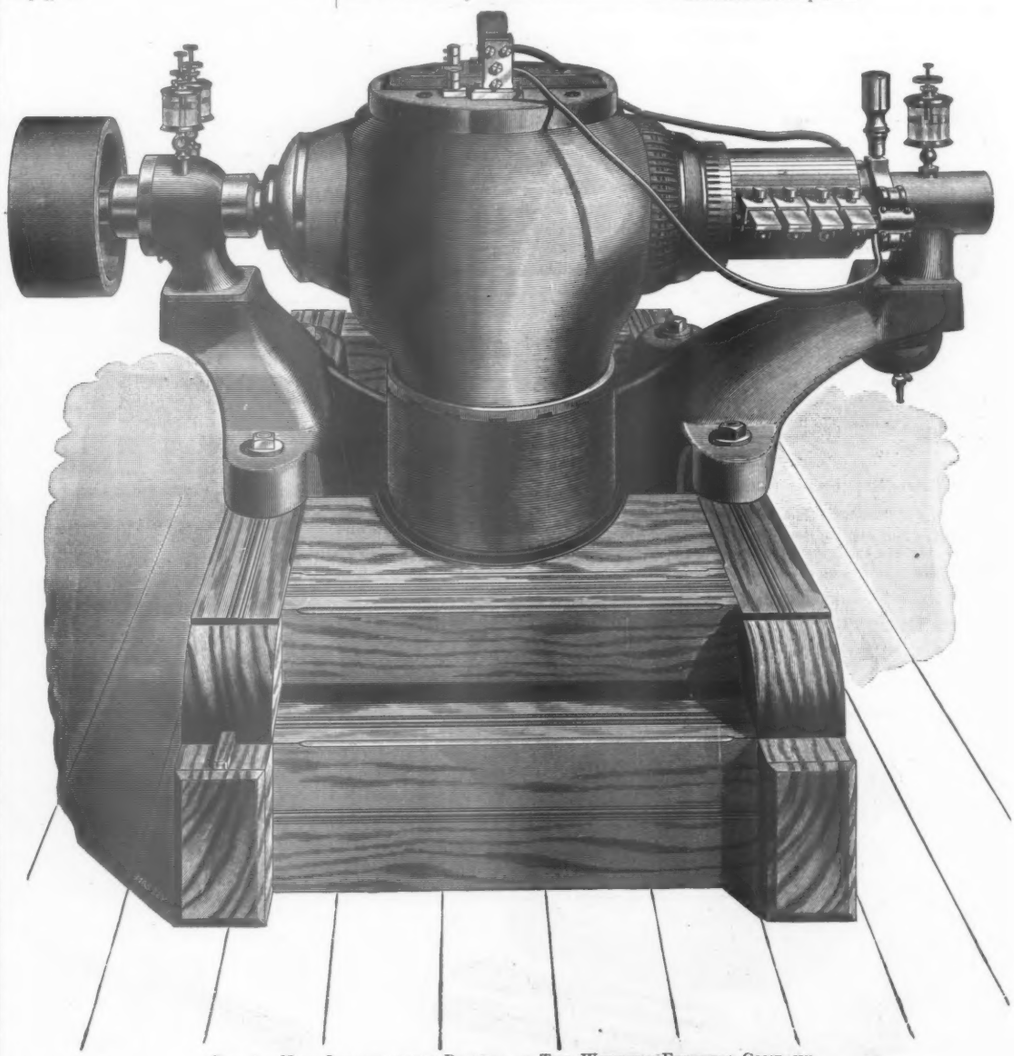


FIG. 1.—NEW INCANDESCENT DYNAMO OF THE WESTERN ELECTRIC COMPANY.

**Piedmont, W. Va.**—The Piedmont Electric Light and Power Company was organized last week; directors, John Sheridan, J. S. Jameson, H. G. Buxton and G. W. Harrison. P. S. Minshall, president. The company expect to have the plant ready for operation by June 1. The streets will be lighted by 2,000 candle power arc lights.

—— The Thomson-Houston Electric Co. have just closed a contract with Monroe County, N. Y., to install 625 incandescent lights in the county buildings at Rochester, N. Y. The company expect that this number will be increased to 1,250 lights, which they think will be supplied by them.

## More Information Concerning the Recent Decision of Judge Coxe.

To the Editor of Electrical Review:

Dear Sir: To remove any misapprehension as to the nature and extent of the recent decision of Judge Coxe in the case of the Electrical Accumulator Company against the Julien Electric Company, I desire to state that when the Julien Electric Company first began to manufacture storage batteries, it did it in the old crude way of applying the active matter to the support plate by hand and in the form of a paste. The company soon discovered, however, that this method of applying the active matter was objectionable, first, because of the amount of manual labor required to do the work in that manner, and secondly, because it was found by experiment that it was better to apply the active layer in the form of powder. The superiority of the application in the form of a powder over the application in the form of a "paint, paste, or cement," will be made obvious to the scientific world, as the litigation now in progress in relation to storage batteries is more fully developed. About 18 months ago, the Julien Electric Company devised a machine almost automatic in its action, which fills a support plate with the active matter in the form of powder. This machine, with but one attendant, has the capacity of 40 men, and, what is still better, its work is uniform; while by the method of spreading with paste, no two plates are found to be alike, either in the quantity of material applied or the relative consistency of the paste, etc., etc. To these defects in applying the active matter in the form of a "paint, paste or cement," must be attributed a great deal of the difficulties hitherto met with in the use of the storage battery. It was for the purpose of avoiding these difficulties, as well as to cheapen the product, that the Julien Electric Company adopted the methods above described as now in use. It is for this reason that we can sell storage batteries to-day at a price sufficiently reduced to bring them within the reach of everyone.

When the suit above referred to was begun, our company was applying the active matter in the form of a paste. That fact was admitted by us in our answer. The application in the form of a powder was not brought to the attention of the Court, as it was not at issue. Judge Coxe's decision, therefore, and the injunction granted by him, is confined to the application of the active layer in the form of a "paint, paste or cement." Happily for this company, it abandoned that form of application too long since, to be affected by any injunction that may be obtained. Far from applying the active matter in the form of a "paint, paste or cement," I will unhesitatingly say, that if we were free to apply it in that form, and compelled to do so, we should go out of the storage battery business at once, for we do not deem that form of application can ever be made economical nor efficient.

Yours truly,
Wm. Bracken, President.

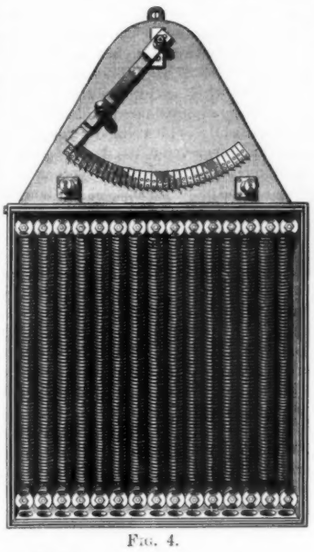


Fig. 4.

Fig. 6.

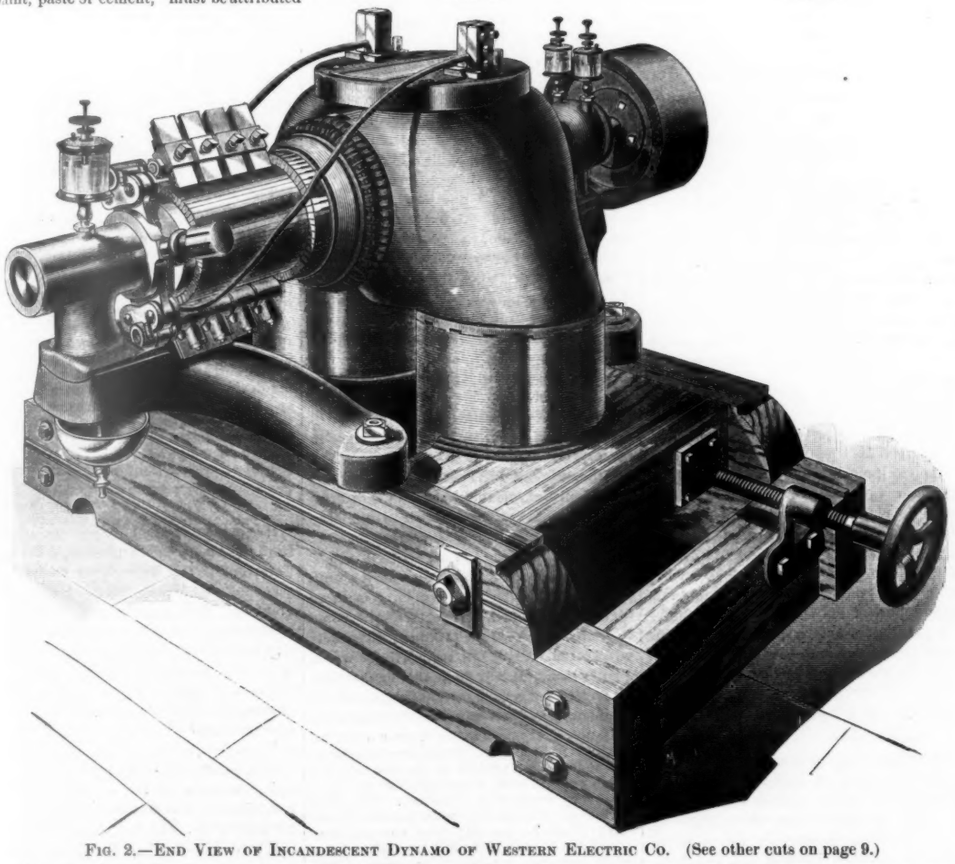


Fig. 2.—End View of Incandescent Dynamo of Western Electric Co. (See other cuts on page 9.)

## The Problem Not Solved.

[From the N. Y. *Mail and Express.*]

But the problem of the wires will not have been solved when every one in the city is down in a subway like those now in use. Whatever may be said of the appearance of the streets, their safety certainly will not be increased by such a consummation. So long as electric wires and gas pipes and steam pipes are under the streets, close to each other, and with no way of getting at them for inspection and repair except by tearing up the pavements, we shall be exposed constantly to danger from explosions of all sorts. It is a very short-sighted policy to go on burying the wires in the way that has been adopted. Let us hope that before long a more rational method will be followed.

**Portland, Me.**—The United States Volta Electric Battery Company; capital stock, $2,000,000, par value of shares being $10. President, Geo. L. Clark, Boston; treasurer, N. C. Woodworth, Chicopee, Mass.; directors, N. C. Woodworth, Samuel May, Jr., Chas. S. Clark.

**Newark, N. J.**—The Institute Electric Supply Company; the incorporators are Robert Prior, Simeon Ayres, Ernest L. Pryor, Thomas G. Roebuck, James Dean Boyd, all of Jersey City, and William Henry Blackburn, of New York. The capital is $100,000, and the company commences business with $300.

**East St. Louis, Mo.**—St. Louis Patent Model and Improvement Company, at East St. Louis; capital stock, $50,000; for inventing, developing and improving new and useful articles; incorporators, H. H. Lienke, William Rabich, L. W. Urban and H. D. O'Brien.

**Baltimore, Md.**—The Southern Electric Light Company of Baltimore; J. Frank Morrison, D. Howard Tuxworth, Frank S. Marr, Alfred J. Carr and David E. Evans. The incorporators will act as a board of directors for the first year. The capital stock is $100,000, divided into 1,000 shares, at a par value of $100 each.

**Toledo, O.**—Toledo Electric Street Railway, $500,000.

**Bellaire, O.**—The Bellaire Gas and Electric Company, $150,000.

**Dayton, O.**—The Miami Valley Electric Company, of Dayton; capital stock, $30,000.

**Cincinnati, O.**—The Southern Ohio Electric Service Company, of Cincinnati; capital stock, $25,000.

**Dayton, W. T.**—The Dayton Electric Light and Power Company has been incorporated, with a capital stock of $12,000.

**Concord, Mass.**—The Concord Electric Company has been organized with a capital stock, $20,000; T. T. Robins, president; C. A. Bowditch, treasurer.

**Toledo, O.**—The Toledo Electric Street railway; incorporators, David Robison, Jr., O. S. Brumback, James J. Robison, Willard F. Robison and L. S. Baumgardner; capital stock, $500,000 in $100 shares.

**Pittsburgh, Pa.**—The People's Light and Power Company; the capital stock is $10,000, divided into 200 shares at $50 per share. The directors are John E. Ridall, Willis L. Eaton and Theo. Kloman.

**Centralia, W. T.**—Centralia Electric Light and Power Company; capital stock, $25,000; trustees, W. E. Partridge, T. R. Barnum and O. H. Romans. Its object is to furnish the town of Centralia, W. T., with electric light.

**Camden, N. J.**—The National Heat and Power Company, with an authorized capital of $5,000,000, of which $5,000 is said to be paid in; the incorporators are William B. Spittall, Geo. W. Cadwell and Geo. Jaeckel.

**San Francisco, Cal.**—The enterprise Iron and Wire Works, with $50,000 capital stock, divided into 5,000 shares; the following are directors: John T. McCormick, George C. Little, Edward Smith, James Trowbridge and Thomas Hooker.

**Portland, Ore.**—The City and West Portland Park Motor Company; incorporators: E. T. Howes, F. E. Ferris and J. E. Bennet. The object is to build a motor line from Portland to West Portland and West Portland Park. The capital is $50,000.

**Syracuse, N. Y.**—The Empire State Watch Company; the incorporators and trustees for the first year are Cornelius W. Smith, Andrew H. Pond and Howard P. Denison; the capital stock has been placed at $10,000, divided into $100 shares.

**Lexington, Va.**—The Lexington Telephone Company has been incorporated with John C. Bounde, president, and J. A. Moore, secretary, to operate telephone and telegraph lines in Rockbridge County. The authorized capital stock is $10,000.

**Chicago, Ill.**—The Smith Safety Steel Railway Car Company at Chicago; capital stock, $1,500,000; for the construction of railways cars of all descriptions, and for buying, selling and operating railroad rolling stock; incorporators, William S. Brewster, Samuel G. Field, William F. Brewster, C. W. M. Smith, and Philip A. Hoyne.

**New York City.**—The Atlantic Postal Telegraph-Cable; the purpose is for operating lines in the United States, which may be extended through Canada, British Columbia and Mexico. The capital stock of $50,000, divided into 500 shares, is held as follows: Edward C. Platt, 385; Richard V. Dey, 50; Andrew Wesley Kent, 50; and James N. Jameson, John M. Platt and Hiram Smith, five shares each. Richard V. Dey, Andrew Wesley Kent, James N. Jameson, John M. Platt and Hiram Smith are the directors.

# ELECTRICAL REVIEW

**Published at 13 Park Row**
**P. O. BOX 3329.**

GEO. WORTHINGTON, - Editor.
CHARLES W. PRICE, - Associate Editor.
T. J. McTIGHE, Electrician and Manager Patent Bureau.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.
TELEPHONE CALL, 546 JOHN.

Timothy W. Sprague, 192 Summer Street, is our representative at Boston, Mass.
Mr. C. C. Haskins, City Hall, Chicago, Ill., represents the REVIEW in the West.

## SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance. Postage paid by publisher.
Great Britain and other foreign countries $4.00, in advance. Postage paid by publisher.

## ADVERTISING.

Transient, 25 cents per line, nonpareil.

## EDITORIAL ANNOUNCEMENT

Address all communications and make all Express Money orders, P. O. orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

☞ No attention will be paid to communications without the *name and address of the writer.*

*We invite correspondence from Electricians, Inventors, and the Telegragh and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.*

*We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.*

*Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.*

**NEW YORK, APRIL 27, 1889.**


## CONTENTS.


| | PAGE. |
|---|---|
| Seeking Revenge Upon a Telephone Company | 1 |
| Direct Triplex Suction and Force Pump | 1 |
| A Victory for the Western Union | 1 |
| Improved Medical Batteries | 1 |
| The Western Electric Incandescent Lighting System | 2 |
| New Storage Battery Cars in Philadelphia | 2 |
| More Information Concerning the Recent Decision of Judge Coxe | 3 |
| The Problem not Solved | 3 |
| New Corporations | 3 |
| Grounded Currents and the Sensitive Telephone | 4 |
| The Wires are Cut | 4 |
| The New Legal Phase of the Electric Light Situation | 4 |
| Storage Battery Traction | 4 |
| Long Distance Talking | 5 |
| Our Boston Leter | 5 |
| Our Chicago Letter | 5 |
| The Electric Club's Annual | 5 |
| Personal | 5 |
| Very Interesting Electrical Experiments Made at Pittsburgh by Mr. Acheson | 5 |
| Telephonic News | 6 |
| Telephonists to Meet at Minneapolis, September 10th | 6 |
| The New Building of the Bell Telephone Company of Philadelphia | 6 |
| The Attack on Wires and Poles | 6 |
| "On the Disturbances Arising from the Use of 'Earth' for Electric Lighting Purposes" | 7 |
| Underground Wires in England | 7 |
| Electric Power | 8 |
| $8,000,000 More | 8 |
| Inspecting Storage Batteries | 8 |
| Electric Light War Ended | 9 |
| Electric Light News | 9 |
| Manufacturing Notes | 10 |
| Sprague Electric Railway at Akron, Ohio | 10 |
| White's Improved Street Railway Rail | 10 |
| Electrical Patents | 10 |


Another year has been added to the life of the Electric Club. May it ever flourish!

An electrical exhibition is to be held at St. John, N. B., commencing July 1st, 1889, and continuing 10 days.

How inconsistent our daily neighbors can be! They have always contended that the owner of property had a perfect right to cut and detach wires placed on it, but this right is suddenly found not to belong to the Manhattan Elevated Railway. How much like other mortals are these self-constituted "moulders of public opinion!"

The graphic remark of Mr. C. J. H. Woodbury at Baltimore, that "as for personal danger, a lineman is in infinitely more danger from gravity than from electricity," received sad verification in this city last week. Two men were killed from falls received while engaged in taking down poles at the command of city officials.

Our citizens, now in darkness, are beginning to appreciate the electric light.

The work of the Patent Office during the past few weeks has been of special importance, several patents having been granted which may have important bearing on future work in the electrical field.

Electricity may be depended upon to come to the rescue every time. An electrical invention has just been announced, which rings a bell in the hotel office and registers the room number when some verdant person blows out the gas.

These are the days when electrical affairs furnish their full quota of the news of the day. The "Wires of New York," is a serial running through the columns of every daily in the country. These same wires are running through the conduits more than before.

Now that the poles are coming down rapidly and the wires with them, and the city is left in consequent darkness, it is apropos to suggest that our police will have pretty active work in caring for the 500,000 strangers who will be here Centennial week, and a little electric light would be of infinite assistance.—*Joe Howard in N. Y. Press.*

The primary-battery electric lighting fraud has arrived in Chattanooga, Tenn. The *Times*, of that city, out of the depth of its ignorance cautiously says: "Those interested in it are exceedingly enthusiastic over it, claiming that it will revolutionize the electric light business, giving a much better light at less cost than the old companies." We trust the *Times* will not purchase any stock—even at $1.00 a share.

The Electric Club is well officered for the year 1889. Mr. E. T. Gilliland, the new president, has been one of the most loyal workers for the success of the Club since its inception, and it is but a proper recognition of his services and his ability, as well as his popularity, that he should be chosen by a unanimous vote to this important position. We predict for the Club a very successful administration for the year 1889, and although the increase in dues may slightly affect the rapid growth of the list of members, yet in the end we have no doubt the Club will be benefited.

Mr. Chas. F. Cutler, president of the New York and New Jersey Telephone Company, has enlarged his telephone duties by accepting the vice-presidency of the Metropolitan Telephone Company of New York City, and will be the active executive officer of that company. He will succeed to a large extent to the telephone duties of Mr. Theo. N. Vail, the president of the company, whose many and important other interests demand more of his attention. Mr. Cutler is a very able and successful executive officer and will undoubtedly win additional renown by the assumption of his new duties.

### *GROUNDED CURRENTS AND THE SENSITIVE TELEPHONE.*

We publish this week a paper by Mr. W. H. Preece, giving an account of some experiments undertaken by him to determine the amount of disturbance which might be created in telephone lines by the proposed conductor between London and Deptford, which is to carry a 10,000-volt alternating current.

Mr. Preece concludes that if the outer sheath of this conductor is grounded as proposed, that all telephones within 19 miles would be seriously disturbed, and that all of the telephones in London would be rendered so noisy as to be entirely useless.

These experiments will be found to be of special value to those who have to deal with the disturbances produced in telephone lines by currents from the wires of electric railroads. They will also be found of particular interest to military engineers as indicating how the telephone, a powerful dynamo and the earth might be utilized to telegraph across a bit of the enemy's country, or to send words of encouragement to a besieged garrison.

### *THE WIRES ARE CUT.*

When the son of Philip II. of Macedonia—Alexander the Great—coming into Phrygia at the head of his ever victorious armies, found himself as unable as his predecessors to untie the knot, with which King Gordian had bound the axle of his chariot to the shrine of the oracle, and, drawing his sword severed it at a single blow, he did an act, which, when seen as part of a dim legend of remote antiquity, has seemed to the modern world as worthy of commendation. But far different is it when, in the zenith of this enlightened age, the chief magistrate of the chiefest city of the Western Hemisphere, confronted with the Gordian knot which his predecessors admitted they could not unravel, has impatiently, with a single stroke of his official power, severed the knot, destroying thousands of dollars worth of property by so doing, and plunging many of the thoroughfares into almost Stygian darkness.

We are not disposed to argue for or against the legality of the recent acts of Mayor Grant in removing the overhead wires of all sorts from several principal streets of New York, immediately following the recent decision of Judge Wallace, against the Western Union Telegraph Company. Time alone can tell if his Honor will be sustained in the course it has seemed wise for him to pursue. Leaving that question aside, we much doubt if there could be found many persons, qualified to form an unbiased opinion, who would approve the vigorous and relentless war which has waged against overhead conductors for the past few days. From the somewhat detailed account which appears in another column, it may be seen that the efforts to temporarily connect by a single wire two portions of cable supplying a large number of lamps was flatly refused.

It does not seem to be a part of modern official action to cut Gordian knots just in that way. In this age, and especially in this country, we have become wonderfully skillful in disentangling complications between those governing and those governed.

It is not always a question of what an official has a right to do, but what is it right for an official to do?

Even—for the purpose of argument—supposing that the state of the art was ripe for the strong arm of the law to compel an immediate removal of the wires, it does not seem as if a more inopportune time could have been chosen for this removal. In a few days the greatest celebration that has ever been held in New York will take place. Hundreds of thousands of strangers will flood the city, and it is the city's business to protect them and surround them with every possible safeguard. These streets that are now deprived of their arc lamps will be crowded on the nights of April 30 and May 1. It is absurd to talk of lighting them by gas. Turning from the arc lights of neighboring streets, their flickering gas jets only serve to make darkness visible. On those nights criminals of all degrees will come forth to fatten on the people; pickpockets will abound; every arc lamp will be worth a policeman. It is possible that danger may be averted by getting the underground arc conductors in service before that time, but it is not likely that in so short a time the service will be as complete or as satisfactory. We have not yet spoken of the interruption of telegraphic and telephonic service, or of that very interesting question: Who will have to pay for all this pole-chopping in the end? Perhaps the city may one of these days have a nice little bill to settle. Of a truth, these are interesting questions, about which we shall all learn much during the next few months.

Possibly cutting the Gordian knot may not bring to our modern Alexander the good luck it brought his ancient prototype, and to him the old quotation may apply: "*Incidit in Scyllam, cupiens vitare Charybdim*"—"He runs on Scylla, wishing to avoid Charybdis."

The bill before the legislature of New York limiting telephone rates to $6 in New York and Brooklyn and $3 in other parts of the State was finally defeated in the Assembly Thursday of last week. The date for introducing new business having passed, there can be no telephone legislation in New York this season.

### *THE NEW LEGAL PHASE OF THE ELECTRIC LIGHT SITUATION.*

Two patents for laminated armatures were issued on April 16, 1889, to the U. S. Electric Lighting Company, as assignees of Edward Weston, which are said to have a vital bearing on the entire field of electric lighting. These patents are the outcome of a seven year's interference in the Patent Office on the issue of priority between Weston and Edison, the former being adjudged the prior inventor. It is said that the Edison Company secured a license under the patents, and have now joined hands with the Westinghouse Company, who control the patents owned by the U. S. Electric Lighting Company, in instituting suit for infringement. The initial step was taken against the machines made by the Ft. Wayne Jenney Company, used by the Manhattan Electric Light Company, of New York, suit having been brought against the latter during the past week. We shall watch with interest the progress of the suit.

In order that our readers can see how the laminated armature business may be affected by these patents, we quote the claims granted in both:

PATENT No. 401,668. DYNAMO-ELECTRIC MACHINE.

"1. In a dynamo-electric machine, the combination, with the shaft, of a cylinder or hub of insulating material secured thereon, iron plates or rings strung over said hub, and plates or sheets of insulating material interposed between said rings, these parts being constructed and combined in substantially the manner set forth for the reception of the coils."

PATENT No. 401,669. DYNAMO-ELECTRIC MACHINE.

"1. A core for electrical generators operating by inductive action, composed of alternate sections, plates, or disks of magnetic and insulating materials, in combination with insulated coils wound thereon, as set forth.

"2. A core for electrical generators operating by inductive action, composed of iron plates, sections, or disks, with interposed plates or sections of insulating material, in combination with insulated coils wound thereon at right angles to the planes or lines of the insulating sections, as set forth.

"3. A core for electrical generators operating by inductive action, composed of iron sections, plates or disks, with interposed plates or sections of insulating material, in combination with means for binding and holding the same together and insulated coils wound thereon at right angles to the planes or lines of the insulating sections, as set forth."

### *STORAGE BATTERY TRACTION.*

The statement presented by the Julien Electric Traction Company regarding the use of storage batteries on Fourth avenue, New York, will be read with great interest. This company has made great progress, not only in improving its battery, but in perfecting the numberless details which a new system of such magnitude must require. The single item of inspecting the car and changing the battery is now done in less than five minutes—a very practical battery shifting device being used. The Julien Company, speaking from its past experience, estimates the cost of motive power for a car-day of 60 miles to be $3.10. This is much better than the best figures we have seen relating to horse traction.

### *LONG DISTANCE TALKING*

It is evident we may expect great things from the American Telephone and Telegraph Company, if the increase of capital stock asked of the Massachusetts legislature is granted. This request will undoubtedly meet with the favor it merits, and then we may expect very rapid extension of the lines of the long distance telephone system, and will see a condition wherein the instantaneous transmission of intelligence will have reached a perfection never dreamed of by the most sanguine telephonist of a decade ago.

On another page we publish a very interesting account of the hearing before the committee on mercantile affairs of the Boston legislature. The statement of Mr. Forbes that from $7,000,000 to $8,000,000 would be spent in line construction during the next four years, coming from a source of such authority, must be particularly gratifying to the officers of the American Telephone and Telegraph Company, who have labored so earnestly and efficiently in developing this remarkable and most valuable application of the telephone.

The statement of Mr. Higginson, the banker of Boston, as to the value and importance of the long distance telephone (which appears in the article we publish on another page), is reliable and valuable testimony as to the merits of the long distance system, coming as it does from a daily patron who cheerfully and without solicitation speaks at length of the benefit it has been to him in his business.

## OUR BOSTON LETTER.

**Sailed for Europe.**—Mr. A. S. Garfield sailed Saturday for Europe via the French line, and will proceed to Paris where he is to take charge of the Thomson Electric Welding Company's exhibit at the exposition.

**Motor Business.**—Messrs. Sawyer & Blake, the N. E. agents of the Sprague Company, have installed the following motors in Boston during the past two weeks: W. A. Knight, ½ h. p. for sewing machine; William O'Brien, ½ h. p. for same use; Plymouth Rock Pants Co., 5 h. p. for sewing machines; C. W. Barron, 2 h. p. for printing; Western Union Telegraph Company, for Gold and Stock ticker, 20 h. p. Edison dynamo service; American Health Supply Company, 2 h. p. machinery.

**Standard Electric Co.**—The Standard Electric Company, of Vermont, of which Mr. W. S. Hill, of this city, is chief of executive committee, and Mr. L. A. Milbank, manager, is installing a 150 light plant of the Standard system at the Chestnut Hill pumping station. The station and reservoir are one of the objects of interest of Boston, and the chance to make this electric installation not the least attractive feature, is being taken advantage of by the Standard Co.

**Coming Change of Offices.**—The Thomson Electric Welding Company will remove its general offices about June 1 to the new Fiske Building on State street, which is to be one of the finest office buildings in the city.

**Marriage in the Fraternity.**—Mr. F. C. Spaulding, of the firm of Spaulding & Buck, was united in marriage to Miss Jessie Fillebrown on Wednesday evening last, at the residence of the bride's father, in this city. Mr. and Mrs. Spaulding will spend some time in travel in Maine before returning home.

**Contracts of the Jarvis Engineering Company.**—The Jarvis Engineering Company, 61 Oliver street, Boston, have been awarded the contract to furnish the steam plant for the new station of the Millbury Electric Company. They will put in two boilers set with the Jarvis Patent Furnace, an Armington & Sims engine, national heater, Sheffield grate bars, etc. Among the many orders just received are a 12½" x 10" Armington & Sims engine from the Eastern Electrical Construction Company, for the new steamboat being built at Bath, and a 210 horse-power tubular boiler to be set with the Jarvis furnace with the special Jarvis front and felting, for Rockland, Me. T.W.S.

April 22, 1889.

## OUR CHICAGO LETTER.

**Stars and Sparks.**—The Metropolitan Opera House Company from New York will give a season of Wagner operas at the Chicago Opera House, commencing on the 22d. Electricity is to be made a considerable factor in the rendering of the operas. The forging of the sword in "Siegfried" is made highly realistic by means of the sparks from an electrically-heated iron wire. At each blow of the hammer a shower of metallic scintillations flies in all directions. In the "Walkure," too, the magic sword responds to the sound of the sword motive by flashing at its hilt. An electric light is placed beneath the hilt, and the current is thrown through the filament by a concealed push button.

**The Club.**—The last meetings of the Chicago Electric Club in its present quarters were held on Monday night, when Mr. Fred Deland read a carefully prepared paper on the rise and progress of the Club, and on Thursday evening, when the annual election occurred. The ticket which the REVIEW published last week was elected without opposition, everyone seeming perfectly satisfied. The banquet which one of the electrical correspondents announced for the 18th instant, did not materialize, for he, the only individual who knew of the whereabouts of the sumptuous repast, did not come round and bring it with him.

**Sharp Practice.**—Iowa City, Iowa, has a "City Electric Light Company." It also is the possessor of a "City Gas Company." These two companies have been at loggerheads as to lighting the city. A representative of the gas company deposited half the stock of the company with the First National Bank of Chicago, as security for a loan. The electric light company nosed out the facts in the case, and eventually bought this stock, which was used in voting on the subject of lighting the city. The gas company—the remnant—sought relief in the District Court, but the judge held that the sale and purchase were valid, and now the electric light company will furnish the city illumination, to the great disgust of the balance of the gas company.

**The Telephone.**—What I have said about the telephone—three or four times—stands. All attempts to bring the bill forward fail as sure as a three dollar watch. This paragraph might be kept standing for the present, or until the wise men of Springfield go home to their cornfields and wood chopping. C. C. H.

Chicago, April 20.

## The Electric Club's Annual.

ELECTION OF OFFICERS — THE BY-LAWS CHANGED—A PLEASANT SOCIAL EVENING.

There was a large attendance of both resident and non-resident members at the annual meeting of the Electric Club Thursday evening of last week. Although purely a business meeting, several of the versatile members of the Club presented a most entertaining informal programme. Messrs. Hine and Gregg were the accomplished vocalists, and Mr. Robert Spice captured the audience with his rendition of solos on that much abused instrument, the concertina, and then gave a few amusing illustrations of "illusion." One of the chief features was the piano run by electricity, which, through the kindness of Mr. Chas. W. Spear and Mr. W. B Tremaine, was loaned to the Club for the evening. The electric light plant of the Club furnished the current, and a little "C. & C." motor concealed in the piano furnished the power. It was a novel sight, when the current was turned on, to see the keys go down as if pressed by invisible fingers. Many gentlemen were skeptical as to the source of the fine music, but on opening the top of the piano they saw the keys striking each note, and became convinced. The electric piano is a new thing in electrical work, and its first public bow was very properly made at the Electric Club.

THE ELECTION.

The annual meeting was called to order at 6 o'clock, and Mr. H. L. Storke was elected chairman; Mr. Chas. W. Price, secretary of the meeting.

Mr. Storke appointed as tellers Mr. Horace B. Miller and Mr. Geo. F. Porter, and Mr. H. A. Reed as alternate.

Before balloting commenced the secretary announced the declinations that had been received, and read the following letter from Gen. O. E. Madden, who was one of the nominees for president of the Club:

NEW YORK, April 18, 1889.

My Dear Mr. Price:

Understanding that Mr. Gilliland has decided to accept the nomination as president of the Electric Club, I beg to withdraw my own name. In so doing it gives me pleasure to bear testimony to the many and valuable services which he has rendered the Club, his fitness for the position, and to express the hope that his election may be unanimous.

May I ask you to read this to the meeting this evening, at which I am sorry to say I am not well enough to be present.

Yours sincerely,

O. E. MADDEN.

To Chas. W. Price, Esq., Secretary Electric Club.

The kindly tone and good taste of the above letter caused it to be received with applause, and at the election which followed Gen. Madden was unanimously elected first vice-president, although not a candidate in any sense. The balloting was as lively as is usually the case where electrical workers become politicians for the nonce, and resulted as follows:

President—E. T. Gilliland.

Vice-Presidents—O. E. Madden, Theo. N. Vail, E. N. Dickerson, H. C. Davis.

Secretary—Chas. W. Price.

Treasurer—Willard L. Candee.

Board of Managers—M. W. Goodyear, H. L. Storke, A. H. Patterson, Cyrus O. Baker, Jr., Henry A. Reed, C. H. Barney, John A. Seeley, W. H. Johnstone, Geo. B. Coggeshall, J. C. Tomlinson, J. W. Handren, H. D. Stanley, C. E. Stump.

Committee on Membership—Henry Hine, Lieut. F. W. Toppan, U. S. N., Geo. T. Manson, Geo. Worthington, Henry D. Lyman.

While waiting for the report of the tellers, and after enjoying parts of the programme mentioned above, which were made doubly enjoyable by the witty remarks of Mr. Storke, the very successful presiding officer, Mr. H. C. Davis moved to take up the resolution changing the dues and initiation fee of members. This was done, and the subject discussed at length, every speaker favoring increasing the dues, as it had been found necessary to have more funds to successfully carry on the work of the Club. Mr. Johnstone, Mr. Davis, Mr. De Camp, Mr. Meade and others spoke in favor of the increase, and it was finally unanimously voted to raise the dues of resident members to $50 per annum, and the initiation fee to $50; non-resident members to pay annual dues of $30, and an initiation fee of $25. These changes, it was voted, will take effect the 1st of May, 1889.

It was suggested by Mr. Johnstone that an assessment be made so as to wipe out all the Club's debt, but after some discussion it was decided, on the suggestion of the chair, to leave any further action to the newly-elected management of the Club.

There were a number of visitors at the Club, guests of members, who evidently greatly enjoyed their first introduction to the Electric Club. Among those present were: Prof. J. P. Barrett, of Chicago, who traveled nearly 1,000 miles to attend the meeting; Mr. Powers, of Troy, N. Y.; Geo. F. Porter, A. J. De Camp, H. A. Cleverly, Philadelphia; A. W. Butterworth, of London; Col. L. W. Burnham, of Boston; H. L. Storke, H. C. Davis, H. D. Stanley, H. C. Adams, Cyrus O. Baker, Jr., W. A. Blaney, W. H. Boyer, E. E. Bartlett, W. L. Candee, J. C. Chamberlain, E. A. Colby, Chas. A. Cheever, John J. Carty, E. W. Carritt, W. D. Dickey, J. B. Ecclesine, Jr., G. S. Evans, T. F. Gaines, M. W. Goodyear, W. M. Garver, James W. Godfrey; A. S. Hibbard, Henry Hine, E. B. McClees, E. T. Holmes, Marshall P. Wilder, E. S. Innet, W. H. Johnstone, Jas. Kempster, E. A. Leslie, H. L. Lufkin, W. D. Ludlow, Geo. H. Lewars, Geo. T. Manson, Horace B. Miller, Dr. Otto A. Moses, Frank C. Mason, J. P. McQuaide, E. F. Peck, H. M. Haines, E. J. Hall, Jr., W. D. Packard, C. McL. Paine, Henry A. Reed, W. D. Spear, Rpbt. Spice, A. F. Stanley, Chas. W. Spear, D. C. Spruance, E. A. Smith, C. E. Stump, Lieut. F. W. Toppan, U. S. N., Chas. R. Truex, John C. Tomlinson, M. W. Mead, Francis H. Wall, Dr. S. S. Wheeler, F. H. Wilkins, A. T. Welles, W. B. Tremaine, C. H. Barney, A. G. Waterhouse, F. G. Waterhouse (of Pittsburgh), James Beesley, A. V. Garratt, W. J. Morrison, B. B. Nostrand, Jr., M. C. Burns (of St. Louis), G. R. Thompson, Henry Van Hovenburg, A. H. Bauer (of Pullman, Ill.)

## PERSONAL.

Mr. A. W. Butterworth, director of *Industries*, London, Eng., is stopping in New York City, and was a guest at the Electric Club last week, and is now on his return to England from a trip around the world.

Mr. Stephen D. Field, the electrician, is taking a vacation at Stockbridge, Mass., and is enjoying it by planting and testing seeds of all kinds. We have no doubt that sample packages of seeds will be received by Mr. Field from his electrical friends with bountiful thanks.

Captain C. H. Thompson, of the Woodward Electrical Company, Detroit, has been renewing old acquaintances in New York the past week, where he was a welcome visitor in electrical circles. The Captain bears his honors as the most accomplished story teller at the Chicago Convention with becoming meekness.

Mr. E. I. Garfield, secretary of the Thomson-Houston Electric Company, was one of Boston's welcome visitors in New York electrical circles last Saturday. Mr. Garfield's visits to New York are not very numerous or prolonged, but he manages to crowd about two weeks business into one day and returns to Boston with the satisfaction of accomplishing all that he starts out to accomplish.

Mr. Erastus Wiman, of New York, is the author of an interesting and comprehensive article entitled "The Greater Half of the Continent," which appeared in the *North American Review*, and refers to his native land of Canada. The information it contained proved so interesting that Mr. Rice, the editor of the *Review*, waived his exclusive rights under the copyright laws in response to numerous requests, and the article has been issued in pamphlet form, and is much sought after by the people of the United States who desire to be informed about Canada.

Colonel Gardiner C. Sims, the engine man and ex-warrior bold (not ex-bold, but ex-warrior, we mean) may now be welcomed into the ranks of the electrical fraternity as a full fledged electrical engineer. At the time that the large new Edison station in Philadelphia was started, Professor William D. Marks, the supervising engineer, was called to Georgia to see his aged mother, and left Colonel Sims, who was there looking after the large A. and S. engines, in complete control, and those who are well informed say that he ran things in artistic style. He was in charge in all ten days, and ten days experience in that station certainly ought to make a full-fledged electrician of the genial Colonel.

## Very Interesting Electrical Experiments Made at Pittsburgh by Mr. Acheson.

TO THE EDITOR OF ELECTRICAL REVIEW:

In your last issue, you editorially ask the question, "Has practical, economical thermal electricity been discovered?" I believe I am to-day able to answer the question affirmatively. While in this city on a business trip, it has been my good fortune to witness a series of demonstrations of the practicability of converting the potential energy of heat into electricity, by Mr. E. G. Acheson, the electrician of the Standard Underground Cable Company. This gentleman is well and favorably known to the electrical fraternity for his very original investigations in the line of various electrical phenomena, and is not a man to be misled by any *ignis fatuus* in experimental physics. He tells me he has been for several years working on this problem of direct conversion, and he is convinced that he has now definitely solved one part of it.

The invention takes the shape of impressing the converted heat energy upon a circuit in which a current is already flowing, and in this form there seems to be no room for doubt that the conversion actually takes place, and by a simple application of flame. An alternating current flowing through the circuit was measured and its total energy determined by careful calorimetric time-tests which were checked by a simple form of Cardew voltmeter. The heat was then brought into play without any alternation of condition, so that the only possible variable in the combination would be the current due to increase of E. M. F. This took place at once at every repetition of the test, and the checking readings all corroborated each other accurately. The total energy thus measured was in every instance found to be upwards of 100 per cent. greater than when the heat was absent.

The invention is certainly a remarkable one, and is sure to create a profound sensation when finally published in its practical form. The operation can be readily made cumulative so that the increase can be made to far exceed 100 per cent.

The possibilities of such an invention are almost too wide for rational belief, but it may be interesting to mention one or two which occur to me now.

Suppose a distribution system is fed by five alternating current generators of 1,000 lights capacity each, the whole driven by a 500 horse-power engine. By Mr. Acheson's invention the capacity of the plant might be increased to 10,000 lights without adding dynamos, and the heat necessary would be utilized in a direct manner, without the trouble of making steam, and without the enormous waste of 966 heat units per pound of water, representing the latent heat of steam, all of which is a dead loss in present day steam plants.

On the other hand, as is frequently the case, suppose an isolated plant to be found insufficient for the growing requirements in a manufactory. Instead of adding another generator and an engine to drive it, the proprietor can take the Acheson system and double up the capacity of the plant with the thermo-dynamic generator. Again, in many instances there is a water-power available, but not enough. With Acheson's system, the water-power may be utilized to its full extent, and the additional generation effected directly from the coal pile.

I think the above pretty conclusively answers the question asked in your last issue. OBSERVER.

Pittsburgh, April 20, 1889.

The copper situation is not much changed. The price to the consumer is about the same as before the failure of the French syndicate. However, it would seem that the price must decline. The total production in 1889 will doubtless not exceed 1888, viz: 255,000 tons, and may be curtailed even more, but is scarcely likely to be brought down to 220,000 tons, the total of 1887. In order to carry off this amount, deliveries in England and France must at least equal 1887 or about 110,000 tons. Recent deliveries have averaged only about 5,000 tons per month. The increase in consumption will have to be very great before there is any chance of a reduction in the existing stock of the metal.

## Telephone News

*** Up in Morrice, Mich., 13 miles of poles and wire belonging to the one-time existing Cushman Telephone Company, were sold last week on an attachment.

*** The opening of a long distance telephone office in Auburn, N. Y.—the home of Col. H. L. Storke and Col. Daniel Lamont—has greatly pleased the inhabitants.

*** It seems probable that the bill before the Missouri Legislature will be defeated in the Senate. The House passed the bill making rentals $4 per month, but the Senate is opposed to it.

*** There is quite a telephonic wrestling match in progress at Springfield, Ill., in which the solons who favor regulation of telephone rentals and those who do not are participants. The outcome is a matter of much interest to the Chicago Telephone Company and the Central Union Company.

*** A large insurance sign fell during a hard wind in Atlanta, Ga., last week. Had it not been for the telephone wires no doubt several parties would have been seriously hurt. The sign struck the wires and the noise served as a warning to the parties below and no one was hurt. Several cross arms on the telephone pole were broken. Owing to the pole being an office pole that supports the cable boxes, it will take considerable work to repair what would otherwise be little trouble.

*** The introduction in the House at St. Paul, Minn., of a bill regulating the charges for the rental of telephones in cities throughout the State, has created considerable comment by the parties directly interested. In St. Paul the rates charged are $6.50 per month for business houses and $3 for private residences or offices, with an extra toll for making outside and intermediate connections. The bill is practically a copy of the Missouri law, which states that in any city of 5,000 inhabitants and within five miles outside of such city limits, the compensation shall be limited to $3 per month. Extra charges shall be made for connections within the limits mentioned, and in cities or towns of less than 5,000 population, the rental shall not exceed $4 per month, and a violation of the act shall constitute a misdemeanor under the act.

*** A novel application of the telephone has been made on the railway between Saint Valerie-sur-Somme and Cayeux (France), with a view to facilitate communication between a train broken down on the line and the nearest station. The stations themselves are on this line already in telegraphic communication by means of an overhead wire; and in the guard's van of an experimental train was fitted up a telephone with battery of 10 Leclanche cells and call bell. One pole of the battery is put to earth by being connected to the frame work of the guard's van, and the other is joined in the usual way to the telephone, the other terminal of the latter being connected with a wire, by which connection with the existing telephone line can be made at any point. To facilitate this operation the wire is enclosed in a light steel tube, long enough to reach the overhead wire from the roof of the van, and provided at the end with a hook for attachment. Upon ringing up, the stations in front and rear of the train receive the signal, and conversation can be carried on with both simultaneously. The object of this arrangement is to enable the guard of a train, delayed or broken down on the line between two stations, to call for assistance. The apparatus carried in the guard's van is self contained, enclosed in a box, and weighs only about 25 pounds.

### Telephonists to Meet at Minneapolis, September 10.

The Executive Committee of the National Telephone Exchange Association, Secretary Barney announces, has decided, by the unanimous vote of its members, that the next meeting of the Association, which is to be held in Minneapolis, Minn., shall commence on Tuesday, September 10th, at 11 A. M.

Negotiations are pending for a special vestibule train, with dining and other conveniences on board, to convey the delegates from the Eastern States, which it is proposed shall run through without change, from New York to Minneapolis, on limited time. Delegates from New England, from this vicinity, and from all parts of the East, are requested to wait until further particulars are made public, before making transportation arrangements.

The meeting will be held at the West Hotel, Minneapolis, at the date mentioned above. Special rates have been secured at this house for all delegates and attendants.

### The New Building of the Bell Telephone Company of Philadelphia.

The work of erecting the new building of the Bell Telephone Company, on Market street, above Fourth, has been begun by Stacy Reeves & Sons, contractors, and will be pushed so as to have the structure ready for occupancy early in summer. The building will occupy the entire lot, having a frontage of 35 feet on Market street and a depth of 117 feet to Merchant, and will be four stories in height. The two fronts of the building will be a handsome and striking combination of red brick, with terra cotta and iron work ornamentation. Ready access will be had to the upper stories by means of a first-class passenger elevator and two large staircases of carved wood. The top story, which will be used for the exchange, will be 23 feet high. It will be well lighted from windows and skylights, and in all respects will be a model telephone exchange.

The arrangements for receiving and handling the wires are as complete as experience at the Philadelphia office and study of similar exchanges elsewhere could render possible. The system now used at the present quarters of the company will be extended, with such modification of details as are deemed best, together with such alteration as is rendered necessary by the substitution of underground for overhead wires.

Beneath the pavement on the Market street front of the building is a large vault, and hither the wires will be taken in conduits to about the center of the basement. The cables will be run to the first floor to the strong current protectors. From the protectors the wires will be run to the cross connecting board and then run in cables again to the operators' department on the top floor. The basement will be used for storage purposes; the first floor for the supply department; the second for the offices of the company; the third for the laboratory and test department, and the fourth for the operators' department.

Every care will be taken to make the structure as nearly fire-proof as possible, and the offices and other apartments will be handsomely finished in hard wood. The cost of construction is estimated at $80,000. The plans were prepared by Addison Hutton, Jr., architect.

*** Mr. Chas. A. Matcham, manager of the Lancaster division of the Pennsylvania Telephone Company, was married April 7th, at Emans, Pa., to Miss Margaret Ormrod. Telephone men deserve all the happiness there is going, and we congratulate Mr. Matcham, who was true to his name on this occasion.

*** The special committee on telegraph and telephone taxation of the Delaware legislature, after conferences with representatives of the Western Union Telegraph and Bell Telephone Companies, has reported to the House a substitute bill imposing a tax on telegraph and telephone wires of 60 cents per mile per annum for the first wire, 30 cents for the second, and 20 cents for each subsequent wire. The bill reported was passed by the House.

# THE ATTACK ON WIRES AND POLES.

### A Force of Axemen Engaged in Cutting Down Poles on Broadway and Sixth Avenue.

### All the Wires and Poles to Disappear Wherever Conduits are Laid. Two Men Killed by a Falling Pole.

THE ELECTRIC LIGHT COMPANIES THE CHIEF LOSERS—STREETS LEFT IN DARKNESS.

On Tuesday, April 16th, the work of cutting down the poles and wires in all streets where conduits had been laid was commenced by direction of the Mayor of New York, as shown by the following order:

April 16, 1889.

*Hon. D. Lowber Smith, Commissioner of Public Works:*

SIR—You are hereby directed to remove forthwith from the streets and avenues named, poles and wires, also named below, in accordance with Chapter 716 of the Laws of 1887, to wit:

First—On Sixth avenue, from 23d street to 58th streeth, all poles and wires, except the wires of the Western Union Telegraph Company upon the elevated railroad structure.

Second—On Broadway, from 14th street to 45th street, all poles and wires, except the Fire Department line.

Third—On 23d street, from Sixth avenue to Broadway, all poles and wires.

Fourth—On 25th street, from Sixth avenue to Broadway, all poles and wires.

Fifth—On 42d street, from Sixth avenue to Madison avenue, all poles and wires, except a pole on the southeast corner of 58th street and Sixth avenue.

And you are further directed to take up the removal of said poles and wires, as described, in the following order: Beginning on Broadway, at the intersection of 14th street, and to continue up Broadway to 23d street; then on 23d street, from Broadway to Sixth avenue; then on Broadway, from 23d street to 25th street; then on 25th street, from Broadway to Sixth avenue; then on Sixth avenue, from 23d street to 58th street; then on Broadway from 25th street to 45th street; then on 42d street, from Sixth avenue to Madison avenue, the poles and wires referred to; then on 58th street from Sixth avenue to Fourth avenue.

Respectfully,

HUGH J. GRANT,

*Mayor and President of the Board of Electrical Control.*

The above was delivered about 10 o'clock Tuesday, the 16th, and by 11 o'clock the work had commenced at 14th street and Union Square. Subway Commissioner Gibbens and Electrical Expert Schuyler S. Wheeler arrived at the Public Works Department simultaneously with the Mayor's order. Commissioner D. Lowber Smith was on hand, expecting the document, and at 10.20 he summoned Superintendent Richardson, of the Bureau of Incumbrances. To the latter he gave instructions to send a force of men without delay to Broadway and 14th street to begin the work laid out by the Mayor.

The pole on the southeast corner of University place and 14th street was the scene of the first attack. The foreman climbed the pole, while a gaping crowd gathered around and wondered what was going to happen. The nippers were put in use and a Western Union wire dropped into the street. This was followed by others until 12 wires had been rendered useless. The work of clearing the pole was accomplished in six minutes, and the pole was allowed to remain standing to support the now useless wires running south.

Then the forces were divided. One section crossed into the park, and the other gang of workmen began clearing the heavily-laden poles of the Brush Electric Light Company, starting with the pole on the northwest corner of 14th street and Broadway. When the cutters began work it was found that, owing to the delay in notifying the different companies to cut off the electric current, the Brush Company had five circuits still working. The linemen, however, were prepared for this difficulty, and wore rubber gloves. As the nippers went through the wires there was a flash that made the crowd below step aside in lively fashion. In about ten minutes the 18 electric light wires running north on Broadway were rendered useless. The crowd grew larger as the people realized that the war on the wires had begun, and fully a thousand thronged the space around the statue of Lincoln.

While this work was in progress the other gang had cleared the second Western Union pole, which stood in the park a few yards above 15th street. It was a long pole, and as the lineman descended from his perilous position it swayed. At that moment the street was crowded with people and vehicles of all kinds, but few of the spectators realized the danger threatened.

A crackling sound was the only note of warning heard, but it was sufficient for the throng, which scattered almost instantly. The pole, with its half-dozen cross-arms, toppled over just as a Broadway car was standing at the street crossing to allow a woman to get off. A cry of mingled warning and horror went up from the crowds as the pole inclined toward the car, which had about 15 passengers on board, mostly women.

The driver saw his danger, and with a single bound jumped from his car just as the pole crashed to the ground, the part bearing the cross-arms falling between the dashboard of the car and the horses—a narrow escape for passengers, horses and car. The horses started to run, but the lumber impeded their progress, and the driver soon had them under control.

Two women fainted, and the remaining passengers, men and women, fled terror-stricken from the car. The pole, it was discovered, was rotten at the base, but the workmen were careless in starting the work. Superintendent of Incumbrances Richardson, had his wagons and men on hand, and as each wire was cut, it was rolled and placed in a guarded wagon. This work continued through the day, and by night Union Square and Madison Square and the adjoining streets were in a state of darkness, with the exception of the occasional dim glimmer of a lonely gas lamp.

The next day the work continued. The electric light companies sent a force of men ahead of the city's forces, cutting down and hauling away the wires and poles, thereby saving them from being carted away by the Department of Public Works. It is estimated that 200,000 feet of telephone, telegraph and electric light wires were removed from poles in the subway district of the city between 6 A. M. and 4.30 P. M. the second day, and over 70 poles during the same time were cut down. Of the wires removed 100,000 feet belonged to the Western Union, Metropolitan Telephone and the electric light companies, and was removed by the men employed by the Department of Public Works. The remaining 100,000 feet was cut down and taken away by men employed by the Brush and the United States Illuminating Companies. Of the poles removed 42 were cut down by the department men, and the rest by employés of the United States Illuminating Company. Some 500 arc lamps were extinguished, and New York, in her most popular evening locality, was very gloomy and uninviting. No electric lights were in use Wednesday night in Fifth avenue from 28th street to 59th; in Broadway, from 14th to 59th; in Seventh and Fourth avenues between 18th and 59th; in First avenue from 47th to 59th; nor in 14th, 23d, 34th, 42d, or 59th streets. This applies only to lamps used for lighting the streets. The Brush and East River Companies were able to make the necessary connections, and had a few commercial lights going on the south side of 14th street and in Fourth avenue.

In anticipation of another night of darkness, the Bureau of Lamps and Gas made strenuous efforts to get the gas lamps on all streets north of 14th to 25th, between Broadway and Sixth avenue, ready for use, and at nightfall a majority of them had been fitted with globes and were lighted. The contrast between the yellow, flickering glow of the gas jets in the streets north of 14th, and the brilliant glare of the electric lights, run in instances by local plants in the big hotels, was striking. The appearance of Broadway in daylight in the section from which poles and wires have been removed, is also much changed.

The Gold and Stock Company suffered severely by the wire-cutting, all of its tickers above 14th street on the west side having been rendered useless. The company is operated by the Western Union under a long lease. Superintendent Humstone said that the Gold and Stock Company had been treated unjustly by the Board of Electrical Control. It had laid a cable in Broadway last February, and had applied for subsidiary ducts, which the Board had not granted. He thought it unjust to the company to destroy its facilities before providing it with others. The telephone wires in 23d street were allowed to remain for a few days, as the company will be able to dis-

pense with their use within a week. There is no public subway in the street for telephone and telegraph wires. The Western Union operates its own conduit, and the telephone company will establish a distributing system from the Sixth avenue cables. The conduits in 23d street are, therefore, for electric light wires exclusively. The telegraph and telephone companies will not be seriously affected by the raid on the poles and wires until operations begin in the downtown sections.

Colonel W. L. Strong, representing the Brush Company, called on the Mayor, Wednesday, and explained that it was through a misapprehension of his order that the current was allowed to remain on the wires while they were being removed on Tuesday. Col. Strong asked permission to run an overhead wire from the end of the Brush cable at Broadway and 34th street to 35th street, in order to connect with a line that would enable it to light Fifth avenue. Expert Wheeler and Engineer Kearney of the Board of Electrical Control, indorsed the application, but the Mayor refused it, saying that the wires were going down, not up.

Several hotels and clubs supplied by the United States Illuminating Company had to resort to gas. The East River Company also had to temporarily give up their line in Sixth avenue, between 23d and 33d streets, but a cable had been prepared, and the lights are now going again. It is probable that a number of hotels and clubs supplied by the United States Company will be cut off, and although this company is now working hard to get its wires underground, it may be two weeks yet before it is in good shape again. In order to allow the men to work as late as possible, some of the companies delayed turning on the currents until an unusually late hour, and many customers supposed they were cut off until surprised by a sudden burst of light.

None of the wires belonging to the city used for fire alarm and police service were disturbed.

Thursday's work of removing the poles cost one life, and perhaps two. A large 70-foot pole was being lowered on Sixth avenue by the inexperienced employés of the city's forces. Michael Early and Hugh Reilly took the guy rope into the third story of a building, using a crowbar placed across the window as a stay around which the rope was turned. The pole was cut, and then began the work of lowering it. It came down all right about half way. Then the pole sagged toward the building, and the crowbar slipped from its position. The pole was pulled out again, and jerked out the slack of the rope fastened to the crowbar. The crowbar was short and slipped through the window. There was a cry of horror as Reilly and Early came out with it, entangled in the end of the rope, while the pole came down.

Both men fell to the sidewalk. Early fell flat on his face, breaking his nose and crushing his skull. He died in a few minutes. Reilly fell partly on top of him. The blow was so terrific as to crack the paving stone on which they struck. Reilly was terribly hurt, but conscious. Beside the two men lay a few pieces of the window sash. Reilly was taken to the New York Hospital. He was suffering from shock and internal injuries, and his left leg was fractured and several bones of the right foot were crushed. There were contusions on his back, and evidences of concussion of the spine. Nevertheless, the surgeon thought it possible that he might pull through. He was unable to talk much, but said that his fall had been broken by striking the awning over the store. If he survives it will be at least two months before he can walk, and the chances are against his even doing this. His wife called at the hospital in the afternoon. She and her three children, living at 338 East Fortieth street, were dependent on his earnings for their support. Early was single, and lived at 104 Fulton street, Brooklyn.

Reilly has since died.

*** How often we are surprised to see the fire company go dashing by, scattering everything before them in their mad rush to reach the burning building. No alarm had been heard by the people, and the first intimation that a fire in some part of the city was raging, was the sight of the flying horses tearing along with their heavy wagons. The telephone had been the quiet messenger that had conveyed the news in the twinkling of an eye. A fire alarm box was not in reach, and had it not been for the useful little instrument which conveys our thoughts in audible sentences with the rapidity of the telegraph, the home or business block might have been consumed or partly so before help could have reached the scene, if it had depended on a personal call at the engine house of the fire department. These "telephone" alarms are of almost daily occurrence, and their adaptability in this direction enhances their value a thousand-fold.

## "On the Disturbances Arising from the Use of 'Earth' for Electric Lighting Purposes."

BY W. H. PREECE, F.R.S.

The magnetic field produced by a current flowing in a straight wire, and returning through the earth, extends to such distances that it is quite impossible to say where or when or how a telephone circuit in that field would be disturbed by any changes in that current. It is quite certain that if a single conductor between Deptford and London were subject to rapid alternations under a potential difference of 10,000 volts—the current returning by way of the earth—every telephone circuit in the metropolis would be disturbed, and probably rendered unworkable. The law determining the distance to which this influence extends was given by me in a paper read before the British Association at Manchester in 1887. It is given in the following equation:

$$C_2 = \frac{C_1\, l}{d^2\, r_2} \times M;$$

$C_1$ being the primary currents, $C_2$ the secondary current, $l$ the length of the primary, $d$ the distance between the wires, $r_2$ the resistance of the secondary, M a constant dependent on the frequency of the primary currents and the rate at which they rise and fall.

It follows from this formula that currents of rapid frequency on a conductor 10 miles in length, carrying 100 amperes, might be evident at a distance of 19 miles. It becomes, therefore, important to decide to what extent disturbing influences can be eliminated. It is well known that if either the disturbing circuit or that disturbed be constructed of two wires so close to each other and so erected that the mean average distance between the disturber and disturbed is the same, no inductive effects are evident, for the influence on one wire is entirely neutralized by the equal and opposite effect on the other. But if this mean average distance is not equal, or if the equality of the two currents be departed from, then a disturbance will arise which will depend on the difference between the two currents and their relative distances. Hence the most perfectly silent telephone circuit becomes noisy when leaks occur in the insulation, and hence it is that the earth plays such an important part in the efficiency of the system.

It was reported in the technical papers that the London Electric Supply Corporation contemplated laying a concentric conductor between Deptford and London, with the external copper conductor in contact with the earth. As it seemed to the post office authorities very doubtful whether such an arrangement would be free from disturbance, experiments were made to test the point. The experiments were made by me in an open space of two or three acres in extent. A concentric cable was constructed so that the outside and enveloping conductor could be insulated or not. The inner conductor was composed of a strand of 19 No. 15 B. W. G. (72 millimetres) copper wires. The outer conductor completely surrounded the inner, and consisted of 24 No. 16 B. W. G. (65 millimetres) copper wires. Each conductor weighed about 1,600 lbs. per mile, and gave a resistance of .56 ohms. The outside sheath was of lead. The following (Fig. 1) is a full-size section of the cable:

The following diagram (Fig. 2) will explain the arrangement of the wires:

Two earth-plates were buried at the points A and B, and between them a No. 7 gutta percha wire was laid along the ground, telephones being inserted at each end. The electric light cable was laid between the same points by a circuitous route, as shown. At the points C and D, two earth-rods were driven in, and another No. 7 gutta percha wire was laid outside the area enclosed by, and about a foot from, the cable.

Beyond each of the gutta percha wires extension wires were carried to enable metallic loops to be made up, forming approximate squares (1 and 2 on diagram).

*Experiment No.* 1.—A Wheatstone transmitter placed at B was connected to the inner conductor (I) of the cable, the lead sheath (L) being used as the return wire. Reversals at top speed (a frequency of 80 per second) were sent through the cable from an E. M. F. of 20 volts, the current strength being about 1.3 amperes.

Loud disturbance was heard in the telephone at A and B when the transmitter was running.

*Experiment No.* 2.—Earth-bars were driven in at the points F and G, and connected by a wire and telephone. Currents were picked up by the telephone through this section, their effect being apparently quite as loud as between A and B.

*Experiment No.* 3.—The points H and I were similarly connected, and with a like result.

*Experiment No.* 4.—The points C and D were next connected by the wire attached to the earth-bars, a telephone being inserted at D. Disturbances almost as loud as on the circuit A B were heard.

*Experiment No.* 5.—The wire C D was disconnected with the earth-bars, and a metallic circuit forming an approximate square was made up (1 on diagram). The interference was still heard, but was only about half as loud as when the earth was used at C D.

*Experiment No.* 6.—The insulated outer *conductor* (O) was substituted in place of the lead sheath as the return wire, and the disturbances in the loop C D ceased entirely.

*Experiment No.* 7.—The outer conductor O) and the lead sheath (L) were coupled together, forming jointly a return wire in contact with the earth. The disturbance in the metallic square 1 reappeared, but was reduced in loudness to about half that in the fourth experiment.

*Experiment No.* 8.—The cable was next laid out straight from A to B, the telephone wire being parallel to it. When the lead sheath was used as the return wire loud disturbance was heard in the telephones at A and B. When the lead sheath and outer conductor were jointly used as the return wire, the noise in the telephones was greatly reduced (to about one-fourth).

*Experiment No.* 9.—To prove that the result obtained in the last experiment was due to earth conduction, a metallic square (2 in diagram) was formed, and the disturbance in the telephones disappeared.

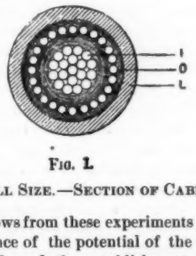



FIG. 1.

FULL SIZE.—SECTION OF CABLE.

It follows from these experiments that the disturbance of the potential of the earth at A and B, and the establishment between these two points of a potential difference, causes currents to flow through the earth between A and B which destroy the equality between those in the inner and outer conductor of the concentric cable upon which equilibrium depends. It is therefore quite clear that the use of the external sheathing as part of the conductor in contact with the earth is quite out of the question; whereas, if the enveloping conductor be insulated it is quite innocent of disturbance, and would not interfere with neighboring telephones.

The question has arisen as to whether the currents experimented with (viz: those produced by a Wheatstone transmitter) are of the same character as those produced by an alternating-current machine. The frequency in the two cases may be alike. Taking the frequency at 100, it will follow that each current, whether it be of the Wheatstone transmitter or of the alternating current machine, will rise from zero to maximum and fall from maximum to zero in .0025 second. The strength of current generally used in the Wheatstone transmitter is 50 milliamperes, while that of an alternating current machine may amount to 100 amperes; and since most of the Wheatstone circuits in this country are long circuits, upon which the resistance and the capacity are considerable, it is quite evident that in actual practice the rate at which the current rises and falls is greater in the case of alternating-current machines than in the case of the Wheatstone transmitter. The fact that it is so is sufficiently proved in actual practice. Before the Grosvenor Gallery Company established their metallic loop system, all the telephones around and about Bond street were disturbed. In order, however, to settle the matter, I have carefully experimented with the currents produced by the alternate current machines at West Brompton and at Eastbourne, and I find that it is quite impossible to detect any difference between the effects of Wheatstone transmitters and alternating-current dynamos.

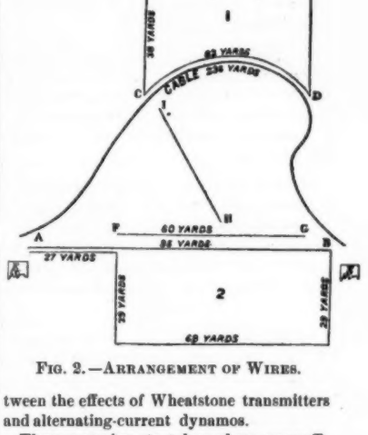



FIG. 2.—ARRANGEMENT OF WIRES.

These experiments, taken alone, are sufficiently definite to render it decisive that the use of the earth in such instances cannot be allowed; but it may happen that in other systems of distribution where the currents are continuous and steady, such as the systems by which it is proposed to distribute by means of batteries, the earth, under exceptional circumstances may be permitted.—We are indebted to the London *Electrician* for cuts illustrated herewith.

.... France and China have agreed to connect the China and Tonquin telegraph lines, and thus establish communications between Saigon and Pekin.

.... The Commercial Union Telegraph Company, Vermont, has declared a semi-annual dividend of five per cent. on the earnings of the six months ending April 1.

.... Edward Howland, receiver of the American Rapid Telegraph Company, has sued out a writ of attachment at Cincinnati, Ohio, on the property of the United Lines Telegraph Company there and elsewhere in Ohio on an alleged claim of $225,000 as compensation for the use of the lines of the company represented by plaintiff, the lines in question extending from Cleveland to Chicago.

.... At Sharon, Pa., recently a test of an electric brake was made, in the presence of Lake Shore and Michigan Southern Railroad officials, by the inventor, Jacob Harrington. The brake is controlled by a dynamo on the locomotive, and a touch by the operator brings the train to a dead stop almost instantly. In case a train breaks in two sections, a separate motor automatically stops the train. The system is made up of a series of magnets on each car. The railroad men predict the success of the new brake, which may be used also upon street electric railways.

### Underground Wires in England.

In reply to a correspondent complaning of delay in telegrams because of overhead wires breaking in a recent snow storm, the British Postmaster General says: "The advantages of laying wires underground are fully appreciated by the department, and a considerable mileage of underground wires already exists; but the system is so much more costly than that of carrying wires overhead as to preclude its indefinite extension."

* * The Metropolitan Street Railway Company has commenced building the electric road from Kansas City to Armourdale, Kansas.

* * The town of Newton, N. C., will vote, on May 6th, on the proposition to issue $10,000 of bonds for electric lighting and street improvements.

* * The Albany, N. Y., Street Railway Company is negotiating with the Thomson-Houston Company for an electric railway. The overhead system is contemplated, and a committee of the directors of the road is investigating.

* * The Thomson-Houston Electric Company will equip the new Lynn & Boston branch railroad from Central Square, Lynn, to Nahant. This addition will be one mile and two cars, making in all a total of four and a half miles and five cars in the Boston and Lynn Electric Road.

* * Mr. Geo. K. Wheeler, of the Thomson-Houston Electric Company, has left Boston for Cleveland, Ohio, to engage in equipping the Brooklyn Street Horse Railway with the Thomson-Houston overhead electric motor system. Mr. Wheeler is an old telephone man who is meeting with success in his new line of work.

* * During the past week another contract for an electric railway equipment has been closed by the Sprague Electric Railway and Motor Co., of New York. This is for an electric railway at Salt Lake City, Utah. The overhead system will include the small silicon bronze wire as a working conductor and the Sprague patented connections, by means of which the connections of the overhead line are made without the use of solder which, in the ordinary overhead line work, weakens the wire by taking out the temper.

* * The city of Pine Bluff, Ark., has let the contract for street lighting to the Water and Light Company, an organization which has been operating there since December. The contract is for seven years and provides for lighting the business part of the city with Thomson Houston arc lights, and the residence parts with incandescent lights. The machinery alterations and extensions are being made under the supervision of the Pond Engineering Company, of St. Louis. It is expected that about June 1st the system will be completed.

* * A large New Hampshire cotton mill is going to adopt a novel system of electric power, which will be installed by the Sprague Electric Railway and Motor Company. The corporation will use water power, which they control, which is about one mile from the mill and which they have been unable to use heretofore. The machinery is constructed and operated as follows: A bank of three water wheels geared to a jack shaft. Next to a third wheel put on a large pulley to the jack shaft, and between the pulley and second wheel is placed a coupling. From the pulley belt on to a short counter is carried a friction clutch pulley belted to a dynamo. When it is desired to operate a motor or to start lights in the mill anywhere, it is only necessary to throw the clutch into action. If lights and motor power are wanted when the mill is not in operation, the single wheel on the jack shaft is employed by starting the one wheel. This one wheel also drives fire pumps, runs elevators in a storage house several hundred feet from the main building, and operates a tramway. From the one dynamo these or any other motors located in the vicinity can be operated.

## $8,000,000 MORE!

### THIS AMOUNT TO BE SPENT BY THE PUBLIC-SPIRITED ADVOCATES OF LONG DISTANCE TELEPHONING.

### TWO LINES BETWEEN BOSTON AND NEW YORK —LINES TO BE BUILT TO CHICAGO.

The hearing before the committee on mercantile affairs of the Massachusetts legislature on the petition of the American Bell Telephone Company for the privilege of increasing its capital stock from $10,000,000 to $20,000,000 took place in Boston Thursday of last week. There were present, besides Messrs. Bruce & Collins, counsel for the telephone company, Messrs. Forbes and Blake, directors; Mr. E. J. Hall, Jr., general manager, and Mr. A. S. Hibbard, general superintendent of the American Telephone and Telegraph Company of New York; Messrs. S. M. Weld and H. L. Higginson, and others. No remonstrants appeared.

In his opening argument Mr. Bruce said that the burden of proof rested upon the petitioner to show that the increased capital stock was needed, and that the work proposed to be done by the company was necessary and wise. He said in nearly every State of the Union, especially in every great commercial State, there exists a general law under which corporations may increase their capital stock without limit, but that Massachusetts had wisely, as he thought, reserved to her legislature the right to decide upon the question of increasing capitalization when the proposed total exceeded $1,000,000. He then sketched the rise of the telephone interest from its small beginnings in 1877, when it first went into commercial use, up to the present time. At the outset it was thought that $450,000 would be an ample capitalization for the business of the company, but it very soon appeared that this was insufficient. In 1879 the original company, with its $450,000 capital, was combined with the New England Company, owning the patents for New England alone, the united capital of the new company, called the National Bell, being $850,000. But at about this time a very remarkable extension and growth of the telephone business began, and it became apparent that it was destined to be a very important business interest, and that a very large amount of capital would be necessary to develop and carry it on successfully. Accordingly in 1880 the legislature was asked to incorporate the American Bell Telephone Company, with a capital stock of $20,000,000. This resulted in the granting of a charter limiting the capital stock to $10,000,000, under which the company has operated up to the present time. But the development of the business has far exceeded the expectations of those interested in the enterprise at that time; improvements and new inventions and discoveries have greatly increased the possibilities of use, and in order to provide the facilities which the public have demanded, and which these inventions and discoveries have rendered possible, very heavy expenditures have been necessary. Five years ago it was not believed that what is now known as long distance telephony was possible. Since that time the company has expended in the construction of long lines for this very purpose $2,337,856 up to the 1st of January last. This is but a beginning, it being the intention of the company to very greatly extend its long distance plant. The new work now laid out and actually building, that is, the line from Boston to New York via Providence, and the line from Philadelphia to Washington, will cost about $600,000, and other contemplated extensions will require the expenditure of several millions of dollars within a comparatively short time. Something over $2,000,000 will be needed to take up the outstanding bonds payable in a little over a year, and, in round figures, $800,000 will be needed for the new building now in process of construction, a building which the requirements of the business render absolutely necessary. Mr. Bruce called attention to the fact that the company has between 2,400 and 2,500 stockholders, that they are scattered through every county in Massachusetts, and that, although the patent of the company, which expires in about three years is undoubtedly a monopoly, being founded upon U. S. law, the company itself is not a monopoly, for it is not owned by any small body of persons. He said that the stockholders were asking for no special favor or grant, but merely for the privilege of investing their own money in an enterprise which has grown to such proportions that additional capital is required.

Mr. Wm. H. Forbes, a director of the company and its president from its organization until 1887, took the stand, and, in response to questions put by Mr. Bruce, said that ever since it had been determined scientifically and practically that long distance telephony was commercially possible, the company had always had it in mind to connect the large cities of the country. This he said involved a degree of expenditure very greatly in excess of the requirements for telegraph construction, it being necessary that the lines should be of copper and that a double or metallic circuit should be used in every case. He gave some figures showing that lines with a capacity of 100 wires cost about $5,000 a mile. The events of the past winter have shown that it is not safe to rely upon a single pole line between two such important cities as Boston and New York, because, although constructed with exceptional strength, storms of sufficient violence to interrupt business will occur. It is for this reason in part that the new line via Providence, now in process of construction, was ordered. While he could not say just how much money the company would spend in long line construction, he felt that it must be prepared to spend some $7,000,000 or $8,000,000 within the next four years. He referred to the new building as a necessity, and he also said that if the business would continue to develop in the future as in the past, it will be necessary for the company again to come before the legislature for further capital.

Mr. Francis Blake, the inventor of the Blake transmitter, said that there was no difficulty whatever in his opinion in communicating telephonically between Boston and Chicago, and that this view had recently been very strongly corroborated by some experiments made by Professor Cross of the Institute of Technology. He said that in his opinion every dollar that had been expended had been wisely spent, and in answer to a question by Mr. Bruce, he said that while there was a theoretical limit to the distance the human voice could be carried telephonically, there was practically no limit. Illustrating this, he said that scientists had shown, long before Bell invented the telephone, that the transmission of speech by means of electricity was theoretically impossible, but nevertheless Bell had shown it to be practically a possible thing. Mr. Blake was asked what improvements had been made in transmitters since the first one was invented. He said that the first transmitter was what is now known as the Bell receiver, or hand telephone. Using this as a transmitter in his house, and talking to his laboratory, he had been enabled to make his assistant hear him when at a distance of three feet from the receiving instrument. Using the latest form of transmitter and the same receiving instrument, over the same length of line, he had found no difficulty in making his assistant hear him when the latter was 50 feet from the instrument.

Mr. S. T. Weld took the stand. He is a user of the telephone between Boston and New York, having an instrument in his office, by means of which he is kept in constant communication with his partner in New York. He said that this service had paid for itself two or three times over, and that it was of a character which could not possibly be done by telegraph. He had conducted with it important negotiations which could not have been carried on by means of telegraphic messages, and he thought it was very much for the interests of business men that the system of long distance telephone lines should be extended throughout the country as rapidly as possible He was in the habit of using the line constantly to Providence and other cities for business purposes, and had always found the service satisfactory in every way.

Mr. E. J. Hall, Jr., vice-president and general manager of the Long Distance Company, explained at length the cost and method of constructing the long lines, the new problems of construction which had been met and solved. He said that in the beginning people were slow to appreciate the advantage which the long lines offered them, but when they came to realize the difference between a telephone conversation and an ordinary telegraphic message, their opinions changed and they used the long line. He said that the lines between Boston and New York had been very largely used, and had proved very successful. At the outset the users were mostly commercial houses engaged in large enterprises which would warrant them in engaging lines for their exclusive use, but that while this branch of the business had continued and greatly increased, there was now a very large and constantly increasing use of the wires by individuals for single communication. Stations had been established at a number of points in Boston and the other cities, and the public becoming more and more familiar with the advantages of the service, was using it to a very much greater extent than ever before. He expected to have a double line in operation to Chicago within two or three years.

Mr. A. S. Hibbard, general superintendent of the Long Distance Company, spoke of the great increase in the use of the long distance wires by the public. He said that the business at the pay stations very nearly doubled every month, and that although the proposed second line between Boston and New York was necessary to prevent interruption of the business in the event of a great storm, it would also be necessary to meet the requirements of the business.

Mr. H. L. Higginson, of the firm of Lee, Higginson & Company, appeared to state the advantages which he derived from being able to communicate verbally with his correspondents in New York. He said that it differed materially from communication by telegraph, inasmuch as it afforded the opportunity for a "give and take" conversation, and that just before coming to the state house he had, by means of his long distance telephone, concluded a very important commercial negotiation which he would not have been willing to trust to the telegraph, and which could not have been carried on by letter, except with great loss of time. He was very certain that the business interests of the country required that this service should be very greatly extended, and that it would be a very great advantage to be able to talk with Chicago as freely as one now talks with New York, Philadelphia and other cities.

There being no more witnesses for the petitioners, the chairman asked whether there were any remonstrants who desired to be heard. This question was asked several times, but no one appeared who desired to speak. The clerk of the committeee stated that the hearing had been extensively advertised in the newspapers of all the principal cities of the Commonwealth. Gen. P. A. Collins then made a brief closing argument, in which he said that it must be remembered that although the American Bell Telephone Company was now prosperous, the telephone had not by any means always been remunerative. Five years elapsed after the invention of the telephone before any dividend was paid. He said that the company was a Massachusetts corporation, that the money invested in the enterprise was Massachusetts money, that the stock was held in Massachusetts and paid taxes in Massachusetts, that the business was founded upon patents which were the result of the ingenuity and skill of citizens of Massachusetts, and that here in Massachusetts and under its laws the company sought the privilege of further extending the developing of the business. The hearing then closed.

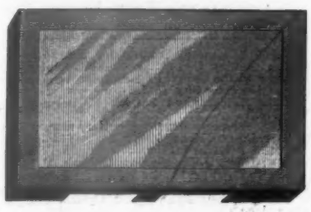
## Inspecting Storage Batteries.

A party of Boston aldermen visited New York City this week for the special purpose of inspecting the storage battery system of the Julien Electric Company. They were met at the depot by Mr. Edward O. Coles, vice-president of the Julien Electric Traction Company, and Mr. Henry Weston, solicitor of the company. After breakfasting at the Equitable building as the guests of the Julien people, they took a couple of the cars of the Julien Company on 4th avenue, which are run daily by storage batteries, and made the entire trip from City Hall to the 85th street station, and were apparently greatly pleased with what they saw of the work of the storage battery system and its operations on this line.

The aldermen were accompanied by Mr. M F. Dickerson, Jr., representing the West End Street Railway of Boston; Harvey N. Shepard, counsel for the Bell Telephone Company; I. H. Farnham, electrician of the New England Telephone and Telegraph Company, and W. H. Clark of the Thomson-Houston Electric Company. From here the party goes to Cincinnati to inspect the Daft trolley system at that point, and will make a tour that will probably take in St. Louis and other Western cities.

### Electric Light War Ended.

The electric light trouble at Middleborough, Mass., has been settled satisfactorily. After the town officers cut down part of the poles, the company's agent thought best to stop work. The officers of the Middleborough Electric Light and Power Company consulted with the town authorities and decided to meet the commissioners and locate poles to the satisfaction of both parties.



—— Eighteen hundred and forty shares of the stock of the Troy Gas Light Company have been transferred in blank to the American Loan and Trust Company, of New York. The trust company is said to act for

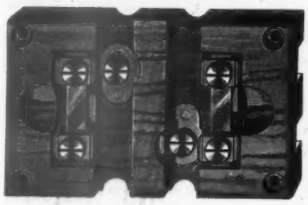


FIG. 12.

E. C. Benedict, of New York, and A. N. Brady, of Albany. The price paid was $125 per share, or $230,000. The purchasers gain control of the Troy Gas Light Company and a monopoly of the gas property of Troy.

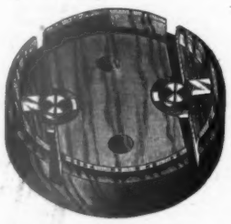


FIG. 11.

—— Alexander Kempt, the Chicago agent of the Brush Electric Company, still keeps the good work moving, and the fruits of his recent labors have shown in an order for six machines to furnish current for 4,000 candle-power lamps, together with a number of lamps for the same. This apparatus will be used on river steamers. Mr. Kempt has also ordered two Brush incandescent machines with capacity of 150 lamps each, together with lamps, etc., to be used in Wisconsin.

FIG. 10.

—— A Baltimore dispatch says: It is understood that unless the Brush and Waterhouse Electric Light Companies settle their fight for the city's patronage before the time for the meeting of the City Council, the former company will offer to do the work for the ensuing year at a very low figure. It is rumored that the Brush Company will offer to do the work as low as 15 cents per night per lamp, hoping to crush the Waterhouse Company out of existence, and for the several years next ensuing, leave the field in Baltimore clear to the Brush Company.

—— A lecture that greatly interested the members of the Buffalo Electrical Society, was delivered before it last week by Mr. Frank G. Raichle, of the local Thomson-Houston Company, on "Arc Lighting."

—— Stuart & Altenberg, having resigned the agency for the Edison Electric Light Company at Cincinnati, are now interested with the Central Thomson-Houston Company, of Cincinnati.

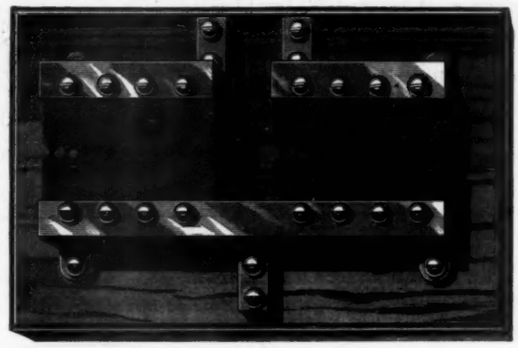


FIG. 7.

—— The Baton Rouge Gas, Electric Light and Power Company has been formed, with a capital stock of $60,000, by the consolidation of the Baton Rouge Electric Light and Power Company and the Baton Rouge Gas Company.

—— A bill has been introduced in the Ohio Legislature giving the Board of Public Affairs in Cincinnati power to compel electric light companies to put their wires underground. If this thing keeps on, the lineman's avocation will be gone.

FIG. 8.

—— Mr. John E. Ridall recently placed orders with the Brush Electric Company, whom he represents, for two of their 45 light 1,200 candle-power arc machines. These machines will be used in Pennsylvania.

—— The contract for putting up patrol electric systems in the northeastern and southwestern districts of Baltimore, has been let to the Southern Electric Company, at $5,500.

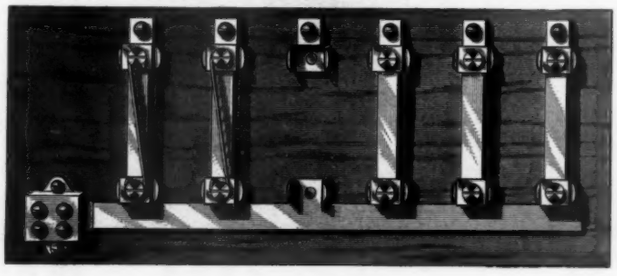


FIG. 9.—ELECTRIC LIGHTING APPLIANCES OF THE WESTERN ELECTRIC COMPANY.—(See page 2 for description.)

—— Mr. R. Ludwig, of Lawrence, Mass., has been appointed superintendent of the Lawrence Illuminating Company, which position has been left vacant by Mr. Brock, who is now connected with a company at Patterson, N. J.

—— The Electric Light Company at Chillicothe, O., recently placed an order with the Brush Company for an arc light dynamo with capacity of from 40 to 45 lamps of 1,200 candle-power each. Lamps were also ordered for the machine.

## ELECTRIC LIGHT NEWS

—— At Westerly, R. I., the gas company has decided to go into electric lighting.

—— Cleveland, Ohio, is now considering the question of creating the office of city electrician.

—— The new Westinghouse electric light station at Minneapolis, Minn., is to start May 1st, with 3,000 lights.

—— The new Edison electrict light station at Minneapolis, Minn., W. T. Andrews in charge, started up April 15th.

—— Another accident resulting from escaping gas occurred in a hotel at Minneapolis, and two ladies narrowly escaped suffocation.

—— The Seneca Falls (N. Y.) Electric Light Company is pushing the work of erecting circuits, and will soon be ready for street lighting.

—— The rise of the Thomson-Houston Electric Company has been phenomenal. The shares with a par value of $25 have been quoted as high as $315.

—— President Edwards, of the Electric Light and Power Company, Charleston, S. C., has purchased incandescent machines which will add 50 per cent to the facilities for incandescent light in the city. The demand for the electric light is increasing.

—— The directors of the Thomson-Houston Electric Company were all re-elected at the adjourned annual meeting of the stockholders held in New Britain, Conn., last week, as follows: H. A. Pevear, J. N. Smith, D. F. Spinney, S. A. Barton, C. H. Newhall, Elihu Thomson, C. A. Coffin.

—— At a meeting of the newly elected trustees of the Ball Electric Light Company, of this city, the following parties were chosen for officers: William L. Brown, president; Sherman H. Knevals, vice-president; Charles E. Ball, secretary; James H. Breslin, treasurer.

—— The California Electric Light Company have placed another 40 to 45 light 1,200 candle-power Brush arc machine, and from the number of orders that come in from the California representatives of the Brush Electric Company, it would seem that the people on the Pacific Coast appreciate these lights.

—— Electric light plants and machinery are wanted as follows: Incandescent plant of 15 to 25 lights, with engine to run it, by Fayetteville Milling Company, Fayetteville, Ark.; 700 incandescent light plant, by the Searcy Electric Light Company, Searcy, Ark.; small electric or gas plant to light the town, by G. H. Hughes, Jr., Morganfield, Ky.; 600 incandescent light plant, including 75 or 100 horse-power steam plant, by J. B. Dillon, Jonesboro, Ark.; small plant by the Estill Springs Company, Irvine, Ky., and M. F. Cole, Newnan, Ga.; 150 incandescent light and 10 arc light plant, including engine and wiring for hotel, by Thos. V. Hall & Co., Chattanooga, Tenn.

—— The Westinghouse Electric Company, during the first half of the present month, received orders for alternating current outfit aggregating a capacity of 10,750 lights. These included initial orders from St. Joseph, Mo., 3,000 lights; Newburgh, N. Y., 1,500 lights; Decatur, Ill., 750 lights; Oxford, O., 1,000 lights and a 50 light Waterhouse arc outfit; Wyoming, O., 750 lights; New York, The Safety Light, Heat and Power Company, 3,000 lights; increase of existing plants, Washington, Pa., 750 lights. A year ago 79 central stations were using or erecting Westinghouse alternating plants; on the 15th inst. the number had reached 160, with an aggregate capacity of 300,000 16 candle power lamps.

# KINDRED INTERESTS

## MANUFACTURING NOTES.

**The Central Electric Company,** of Chicago, have taken the agency for the Detroit storage battery.

**Parrish Bros. & Peck,** of Detroit, have opened an office in Chicago for their electrical train signals.

**Leonard & Izard,** of Chicago, after a sharp contest in which all the competition in the country took part, have closed the contract to light the city of Rushville, Ind., with 10,000 incandescent lamps.

**C. R. Vincent & Company.**—Since establishing their New York office at 15 Cortlandt street, this company has built up a splendid business for the Ball high speed engine, and have recently commenced handling the Manning boiler, a new applicant for favor in boiler circles, that is receiving some of the highest praise.

**E. P. Gleason Manufacturing Company.**—In the successful working out of the electric light appliances, fittings, insulators, etc., this company has become particularly successful, and its new catalogue E and supplement have been widely sought after by electric light people. Mr. E. F. Gennert, the superintendent of this department, is to be credited with a great deal of this valuable work, and we are pleased to state is reaping a reward in the increase of business that is coming to his company.

**The Empire City Electric Company.**—The recent announcement by this company of its white wood moulding and cleats for inside electric light wiring has brought numerous inquiries and orders, and the shipping department has been busy taking prompt care of them. And notwithstanding all the talk about the burial of the wires in this country the other wood work manufactured at the factory of the Empire company is in large demand, and cross-arms, pins and brackets are included in daily shipments in large quantities.

**The Sprague Electric Railway & Motor Co.**—The large number of railroads which have ordered the new 30 horse-power motor car equipment and improved Sprague motors, would have been sufficient alone to have kept the business of the company devoted exclusively to that branch of the electric power field. But the attention of the company has not been devoted entirely to this class of work. They have recently received a number of large orders for stationary motors, including one to operate an entire mill in Nebraska by electricity, using more than 100 horse-power of motors, with the generating station more than three miles away. In addition to this order, they have received a number of others for less individual capacity, but making a very large aggregate.

**The Pond Engineering Company in Chicago.**—The Pond Engineering Company is furnishing the automatic pumps and receivers, two large feed water heaters for the electric light engines, and two exhaust heads for the Liggett & Myers building, on Washington avenue, St. Louis. They have also furnished the Evansville Gas and Electric Light Company, of Evansville, Ind., with feed water heaters, and the Jerseyville (Ill.) water works with two boilers. The firm has also arranged to establish a branch office at Chicago, at the solicitation of Chicago manufacturers, on account of the withdrawal from business of a firm in the same line of trade in that city. They will start this branch on May 1.

**Frank Ridlon, of Boston,** the widely known electric light man, has sent out a circular letter reading as follows:

"In the early stages of the business a large amount of electric light and electric power apparatus was sold, which has since proved deficient in point of economy in the cost of running and operating the same. This necessitates a change to systems which have given satisfaction and assured dividend earnings. The former, when displaced by more approved apparatus, is not entirely useless, but on the contrary the amount of current developed which proved a losing business when applied to running arc lights, now proves itself a very satisfactory current generator for charging storage batteries. Many other dynamos which have proved unsatisfactory for lighting purposes—more especially central station work, where the strains and vibrations necessary in long distances is very great—have been found both efficient and satisfactory when used in an isolated plant, in the lighting of mills and factories; where the length of the circuit is shorter. Others may be found specially adapted for running motors. It is to bring about these changes and put such apparatus in its proper place where it will give the best returns for the money expended, that I have taken up the business of second hand electric apparatus. I shall constantly have on hand arc, incandescent and power apparatus from which I can guarantee good results for these purposes."

**American Electrical Works.**—Wires may come and wires may go, but the quality of the work turned out by the American Electrical Works, of Providence, R. I., never changes unless it be for the better. But that is difficult if the quality of the work turned out ever since the formation of the company is considered. It is related of Mr. Eugene Phillips, the president of the Electrical Works and one of the most popular gentlemen connected with the electrical fraternity, that it was suggested to him at one time, owing to the great competition in the manufacture of wire, fine covered wires, etc., that his company commence the manufacture of a cheaper grade, properly labeled, to fit certain classes of work. The suggestion was not acted upon, Mr. Phillips very properly appreciating the fact that it would not pay in the end to cheapen the quality of the goods for which his company had become famous. Mr. P. C. Ackerman, the New York agent at 18 Cortlandt street, reports the sale of weather proof wire as having been quite large recently, as well as the unsurpassed magnet wire of this company. The sale of a large order of the Faraday cable, manufactured exclusively by the American Electrical Works, to the New England Telephone and Telegraph Company, of Boston, is one of the recent satisfactory business deals of the American Company. It always gives the REVIEW pleasure to speak of the success of this company, for their work fully merits the recognition it so abundantly receives.

## Sprague Electric Railway at Akron, Ohio.

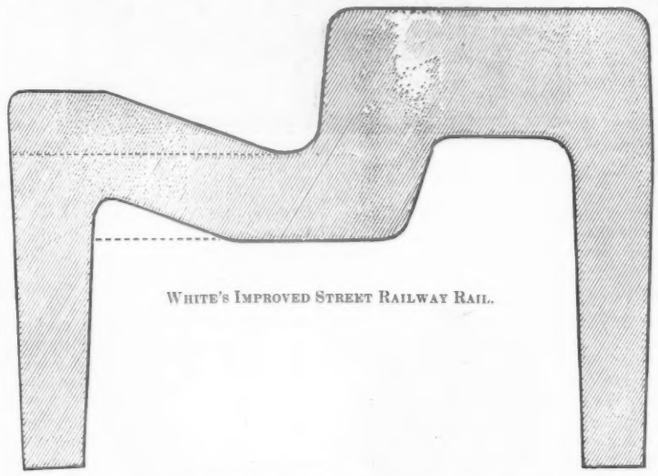
The accompanying engraving presents a view of the Sprague electric cars on the Akron, Ohio, Electric Railway. This road has been in operation about three months, and has been giving satisfaction ever since it had been put in operation.

The management have felt so very well pleased with their electrical equipment, that they have ordered a similar equipment for the principal street railway at Erie, Pa., which is owned principally by the same stockholders.

## White's Improved Street Railway Rail.

The accompanying cut represents a new form of rail specially adopted for electric street railways where a substantial road bed is the essential foundation for the best method known for the propulsion of street cars. This rail was designed by R. T. White, the well-known inventor and manufacturer of street railway material, of 12 Pearl street, Boston. The rail has many advantages over the common flat rail or the girder rails, having a central, vertical rib, and when laid on chairs such as have been designed for its support, it is claimed to be the best rail for the purpose, in the market, as there will be no chance of the rails spreading or rolling, and the paving in settling cannot drop under the head and flange of the rail, which is the case with all other girder rails having a central vertical rib, and proves a serious defect. The flange or wagon tread may be made flat, as shown by dotted lines, but the inventor thinks the raised flange preferable, as more wearing surface can be obtained before the flange of the wheel will touch the bottom of the groove. Carriages can easily pass over or out of the rail, and the groove cannot become clogged, as the flange of the wheel in passing along will act as a wedge to force any stones or dirt up the incline.

Strong patents have been allowed on the rail.



WHITE'S IMPROVED STREET RAILWAY RAIL.

ELECTRIC RAILWAY AT AKRON, OHIO.

# ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING APRIL 16, 1889.

401,332 Automatic cut-out for secondary batteries; Stanley C. C. Currie, Philadelphia, Pa., assignor to the United Electric Improvement Company, Gloucester City, N. J.
401,334 Telegraphy; Patrick B. Delaney, New York, N. Y.
401,338 Process of making battery zincs; Hiram G. Farr, Boston, Mass.
401,348 Attachment for electro-magnetic thermoscopes; Henry J. Haight, New York, N. Y.
401,366 Therapeutic attachment for galvanic batteries; Chauncey V. Osborn, Chicago, Ill., assignor to the McIntosh Battery and Optical Company, same place.
401,414 Process of treating magnetic iron ore; Gurdon Conkling, Glens Falls, N. Y.
401,415 Magnetic separator; Gurdon Conkling, Glens Falls, N. Y.
401,416 Combined lamp shade or reflector and guard; Charles A. Cooley, Montreal, Quebec, Canada.
401,417 Electric lantern; Charles W. Cox and Thomas E. Van Dyke, Philadelphia, Pa.
401,444 Incandescent lamp; Hermann Lemp and Merle J. Wightman, Hartford, Conn., assignors to the Schuyler Electric Company, of Connecticut.
401,466 Secondary battery; John S. Sellon, Hatton Gardens, County of Middlesex, England, assignor to the Electrical Accumulator Company, of New York.
401,472 Electric railway track alarm; Theodore Taylor, Cedarville, Cal.
401,482 Electric heating apparatus for railway systems; Mark W. Dewey, Syracuse, N. Y., assignor of two-thirds to Emil Laass and Charles H. Duell, same place.
401,486 System of electric lighting; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y.
401,498 Wiring structures for electric lighting; Edward H. Johnson and Edwin T. Greenfield, New York, N. Y.
401,515 Underground conduit for electrical railways; Fred. H. Reed, Jersey City, N. J.
401,520 Method of operating electro-magnetic motors; Nikola Tesla, New York, N. Y.
401,527 Cut-out for incandescent electric lamps; Edwin R. Whitney, St. Johnsbury, Vt.
401,580 Method of exhausting electric lamp bulbs; James W. Packard, New York, N. Y.
401,591 Electric alarm advance car; Harry Riesenberg, St. Louis, Mo.
401,606 Manufacture of carbon filaments; Edward P. Thompson, Elizabeth, N. J.
401,607 Manufacture of incandescing carbon filaments; Edward P. Thompson, Elizabeth, N. J.
401,608 Distribution of electric currents; Elihu Thomson, Lynn, Mass.
401,616 System of electric locomotion; Frank Wheeler, Meriden, Conn.
401,617 Electrical measurement apparatus; Anthony C. White, Roston, Mass.
401,632 Dynamo armature; Carl C. C. Billberg, Philadelphia, assignor to Thomas H. Dallett and George A. Dallett, Thornbury, Pa.
401,639 Process of electric welding; Charles L. Coffin, Detroit, Mich.
401,646 Incandescent electric lamp; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y.
401,658 Dynamo electric machine; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.
401,659 Dynamo electric machine; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.
401,682 Electro-therapeutic spectacles; Caspar Brust, No. 64½ Haidhausen, Munich, Germany.
401,688 Magnetic ore separator; Chandler C. Coats, Newark, N. J.


# PATENTS.

## Electrical Review Patent Bureau

**Conducts a general business in the preparation and prosecution of Applications for Patents, in the United States and all Foreign Countries. All business carefully and promptly attended to in the matter of Reissues, Caveats, Trade Marks, Labels, Design Patents, Copyrights.**

**SPECIAL SEARCHES made to determine the question of novelty or infringement.**

**ELECTRICAL PATENTS A SPECIAL FEATURE. All business receives the direct personal supervision of the Manager, whose fourteen years' experience as Patent Attorney and seven years as Practical Electrician, insures thorough and satisfactory work.**

**All communications are strictly confidential, and inventors may address us with entire freedom.**

**Our charges will always be as moderate as first-class work will permit and commensurate with the amount of work to be done.**

**Address,**

**Electrical Review Patent Bureau,**
**13 Park Row, N. Y. T. J. McTIGHE, Manager.**

## WANTED.

**ELECTRIC LIGHT AGENTS** of experience and ability, to sell Arc and Incandescent Apparatus, isolated and central stations. Address with full particulars and references.

DYNAMOS,
Care of ELECTRICAL REVIEW,
NEW YORK.

PARTIES having second-hand Arc Dynamos with lamps for sale will please address the undersigned at once, giving description and price. Address

C. O. S.,
ELECTRICAL REVIEW.

TELEPHONE MANAGER.—A thoroughly competent Telephone Manager of long experience is open to an engagement. Can furnish the best of references from present employers.

Address, S. W.,
care ELECTRICAL REVIEW.

**BROWNLEE & CO.,**
DETROIT, MICH.
DEALERS IN
CEDAR TELEGRAPH POLES.
MANUFACTURERS OF
Cross Arms, Pins and Brackets, Oak and Locust Pins, CEDAR TIES,
For Electric Railways.

**CONDENSERS** WM. MARSHALL, MANUFACTURER. Standards a Specialty
Rooms 2 and 4, University Building, New York.

NOTICE TO THE TRADE.

## A. L. BOGART,

22 Union Sq., N. Y.,

No. 9 Barthaldi.

Is the sole owner of U. S. Patents covering certain Electrical Gas-Lighting Burners, Cut-Offs, Burglar Alarm, Gas-Lighting Attachments, and other electrical appliances connected therewith, all of which are manufactured exclusively by him, and are sold to the trade on the most favorable terms EXPERTS will use none other, on account of their superior workmanship, and practical utility.

Suits are now pending in the U. S. Circuit Courts against infringers of the Bogart Patents in the cities of New York, Philadelphia and Boston.

Illustrated Circulars, price-lists and discount sheets forwarded to the trade on application, accompanied with business card.

## BAIN, 76 Market Street, CHICAGO, ILL.,

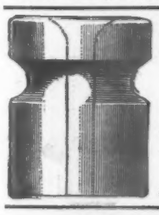
General Electrical Work, in all branches of Electrical Engineering. Consultation, etc. Correspondence confidential. TRY ME.

## WALTHAM

## WATCHES

are the best for electricians, railroad men, engineers and others whose vocation requires a watch that is both absolutely non-magnetic and an accurate timekeeper.

Manufactured and Warranted by the
AMERICAN WALTHAM WATCH CO.
WALTHAM, MASS.



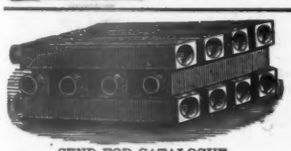
## Porcelain Electrical Supplies and Specialties,

MANUFACTURED BY

## EMPIRE CHINA WORKS,

144 & 156 Greene St., GREENPOINT, BROOKLYN, E. D., N. Y.

Our Ware is HARD PORCELAIN, the BODY and GLAZE IDENTICAL and GUARANTEED NON-CONDUCTIVE for all ELECTRICAL PURPOSES



## THE WYCKOFF PIPE CO.,

MANUFACTURERS OF
WOODEN PIPES FOR
UNDERGROUND ELECTRICAL WIRES.
We have large works for creosoting Lumber, R. R. Ties, Telegraph Poles, &c., &c.

SEND FOR CATALOGUE.

WILLIAMSPORT, PENN.

The Standard Open Circuit Batteries of the World.
"Gonda" Battery and "Gonda Porous Cup" Battery.
The Only Genuine Leclanché Batteries.

The "Gonda" Battery is made only by us. It is Patented Everywhere. Beware of Infringements.

TRADE
# GONDA
MARK.

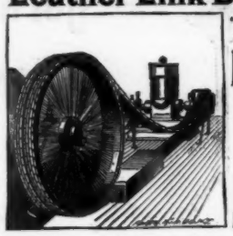
Do not be deceived by imitations. called Disque Leclanché Battery. The Genuine is far Superior.

Do not be imposed upon by Imitations.
Take no Porous Cups without Our Label and Trade Mark.
The Leclanché Battery Co., 149 West 18th St., New York.

GIVES MORE POWER USING LESS WATER THAN ANY OTHER WHEEL.

THE OLD RELIABLE —LEFFEL— WATER WHEEL
SEND FOR CATALOGUE.
JAMES LEFFEL & CO.
SPRINGFIELD, O., OR 110 LIBERTY ST., N.Y.

## AMERICAN Leather Link Belt Co.


"American Patent Joint"

Leather Link Belting
Specially adapted to
DYNAMOS.

FACTORY, 46 & 48 FERRY ST., OFFICE, 72 CLIFF STREET, NEW YORK.
NEW YORK. CHICAGO, BOSTON. PHILA.

# Detroit Electrical Works

MANUFACTURERS OF

## ELECTRIC SUPPLIES,

INCLUDING

Medical Batteries, Skeleton and Box Bells, Burglar Alarms, House Annunciators, Fire Alarm Boxes, Pins and Brackets.

Insulated Magnet, Telephone and Electric Light Wire.

GENERAL OFFICES and FACTORY:
DETROIT, MICH.

Warerooms, 224-232 Canal St., 118-126 Walker St.,
NEW YORK.
Manufactory, Flushing & Carlton Avenues, Brooklyn.

## OXLEY, GIDDINGS & ENOS,

DESIGNERS AND MAKERS OF

## Electroliers and Combination Fixtures

UNSURPASSED FACILITIES
For producing fixtures of the most approved designs for any system of
INCANDESCENT LIGHTING.
Special designs furnished upon application. Suggestions from architects and decorators faithfully executed.

D. W. Baker. Cyrus O. Baker, Jr.

## BAKER & CO.,

Importers, Melters and Refiners of

# PLATINUM,

408, 410, 412 and 414 N. J. R.R. Ave., NEWARK, N. J.
Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native platinum purchased

## This is the Dust-Proof Washer.

BUY NO BELLS WITHOUT IT

## HAZAZER & STANLEY,

## ELECTRICAL HOUSE FURNISHINGS,

32 & 34 FRANKFORT STREET,

NEW YORK.

EUGENE F. PHILLIPS, President. W. H. SAWYER, Secretary and Electrician.

## AMERICAN ELECTRICAL WORKS

MANUFACTURERS OF

Patent Finished Insulated
ELECTRIC WIRES,

TELEPHONE AND ELECTRIC CORDAGE,
Electric Light Wire, Magnet Wire,

PATENT RUBBER COVERED WIRE, OFFICE AND ANNUNCIATOR WIRE, LEAD-ENCASED WIRE, ANTI-INDUCTION AERIAL AND UNDERGROUND CABLES, ETC., ETC.

OFFICE AND FACTORY, No. 67 STEWART ST., PROVIDENCE, R. I.
New York Office: 18 Cortlandt St., P. C. Ackerman, Agent.

# Bernstein Electric Co.

## INCANDESCENT LAMPS

— FOR —

## *ARC LIGHT CIRCUITS,*

SIMPLE. RELIABLE. DURABLE.

The only **safe socket** for series lamps and the **only socket having insulating material** for the outside parts.

Send for Illustrated Catalogue.

**620 Atlantic Ave., BOSTON.**

---

**WRITE** For the Electrical Review's *New Catalogue* of all Electrical and Scientific Books.

**18 PARK ROW, NEW YORK.**

---

*Plating Machines that require a speed from 1800 to 3600 revolutions per minute are Useless Toys.*

**$100.00**

THE

## "LITTLE WONDER"

DYNAMO-ELECTRIC MACHINE.

Over 1000 in Successful Operation. Has the largest sale of any Electro-Plating Machine.

SEND FOR CATALOGUE OF 1889.

Manufactory and Offices,

**Newark, N.J.**

New York Office, 32 Liberty Street.

---

**E. P. Gleason Manuf'g. Co.**

181-189 MERCER ST., NEW YORK.

— MANUFACTURERS OF —

**Electric Light Appliances, Fittings, Insulated Joints, Fixtures,**

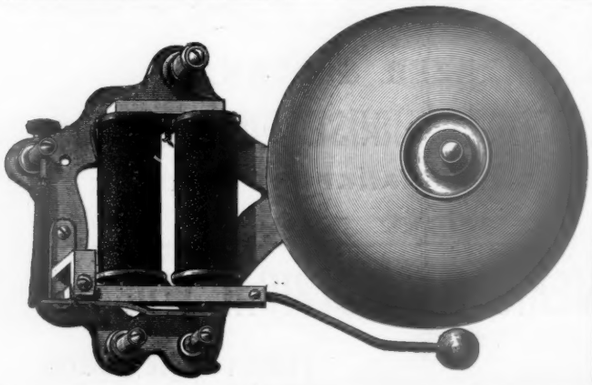
**GLOBES, SHADES, FANCY LAMPS,**

ETC., ETC., ETC.

SEND FOR CATALOGUE E. AND SUPPLEMENT.

---

## Manufacturers



**H. E. & C. BAXTER,**
18 Fulton Street, Brooklyn, E. D.

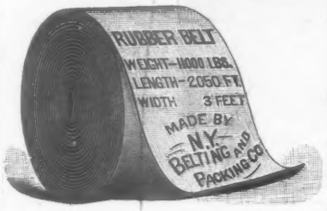
---

# NEW YORK BELTING AND PACKING CO.

**WAREHOUSE: 15 PARK ROW, NEW YORK.**

The Oldest and Largest Manufacturers in the United States of

## VULCANIZED RUBBER




In every form adapted to mechanical purposes.

## MACHINE BELTING,

**With Smooth Metallic Rubber Surface**

This Company has Manufactured the Largest Belts made in the World for the principal elevators at Chicago, Buffalo and New York.

We make a Superior Quality of Belting for Electric Light purposes, for use on Dynamos and Swift running machinery.

**JOHN H. CHEEVER, Treasurer.**

**BRANCH HOUSES AT BOSTON, PHILADELPHIA, CHICAGO, ST. LOUIS,**
**European Branch: Pickhuben 5, HAMBURG, (Freihafengebiet), GERMANY.**

---

# Washburn & Moen Mfg. Co.

**WORCESTER, MASS.**

MAKERS OF

## IRON AND STEEL

MANUFACTURERS OF

**Iron and Copper Wire for Electrical Purposes.**

PATENT GALVANIZED TELEGRAPH & TELEPHONE WIRE,

In Long Lengths, Galvanized by our Patent Continuous Process.

**The Standard with all Telegraph and Telephone Companies.**

Since the first introduction of the Electric Telegraph Service, our patent wire, expressly manufactured for electric purposes, has filled every requisition as regards strength, evenness of quality, and conductive capacity.

Send for Price Lists and descriptive pamphlets, and **"Hand-book of Wire in Electric Service."** Sent free on application.

**New York Warehouse.**
16 CLIFF STREET.

**Chicago Warehouse,**
107 & 109 LAKE ST.

---

Powell's Patent "Signal"

# DYNAMO OILERS.

**THE BEST IN THE WORLD.**

The Filling Hole in top Cup is covered with Snap Lever, which can not be displaced by jarring or shaking of machinery.

Shows oil dropping while machinery runs.

Sight chamber is fitted with square window panes, which are secured by brass end plates, and can be removed for inspection, cleaning or repairs, at any time, while the machine is running.

FIG. 2.

Shows oil stopped when machinery stops.

Flow of oil can be instantly stopped or started, without changing degree of feed.

MANUFACTURED BY

**THE WM. POWELL CO.,**

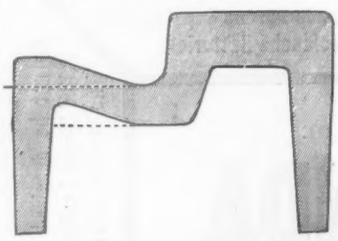
Nos. 50, 52 & 54 Plum St., CINCINNATI, O.

*Please send for Prices and Discounts.*

---

# R. T. WHITE,

*12 Pearl St., (Room 6), BOSTON, MASS.*



**IMPROVED**

PATENTED MATERIAL FOR STREET RAILWAY ROADBEDS.

BEST MATERIAL, LOWEST PRICES,
CORRESPONDENCE SOLICITED.

Rolled any weight desired. Patent allowed.

---

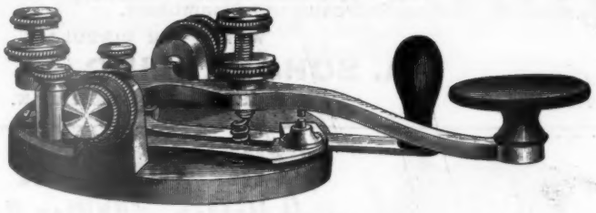
# FARADAY CARBON Co.,

# ELECTRIC LIGHT CARBONS,

PITTSBURGH, PA.

# EMPIRE CITY ELECTRIC COMPANY,

15 DEY STREET, NEW YORK.



OFFICE OF

EMPIRE CITY ELECTRIC CO.,

15 DEY STREET.

O. E. MADDEN, *President.* E. T. GILLILAND, *Vice-President.*

NEW YORK, April 20, 1889.

DEAR SIR—

This beautiful Spring weather causes wide-awake TELEGRAPH and TELEPHONE men to think of putting their LINES and OFFICES in GOOD SHAPE for the coming summer.

They will not make any mistake by sending to us for such supplies needed for this work, as we carry IN STOCK EVERYTHING, "Insulators," "Gravity Batteries," "Cross Arms," "Pins," "Keys," "Relays." "Wire," "Sounders," "Poles," "Switchboards," "Cords," "Switches," "Testing Instruments," "Battery Material," etc., all of best quality. *WRITE FOR PRICES.*

Very truly yours,

THE EMPIRE CITY ELECTRIC CO.

MANUFACTURERS AND DEALERS IN

**Telegraph, Telephone, Electric Light**

— AND —

**ELECTRICAL SUPPLIES**

OF EVERY DESCRIPTION.

All kinds of Bare and Insulated Wires and Cables, Batteries, Bells, Annunciators, Burglar Alarms, etc., Insulators, Pins, Brackets, Cross Arms, etc.

INCANDESCENT LAMPS of best make to fit any socket.

CARBON POINTS of best Foreign and Domestic Manufacture.

WHITEWOOD MOULDING and CLEATS at low prices.

NEW CATALOGUE JUST PUBLISHED.

**In Fact, Everything in the Electrical Line**

Estimates Cheerfully Furnished. Correspondence Solicited.

Discount Sheet furnished to any one in the Trade on application.

## EXTRACT FROM THE REPORT

— OF —

DR. SCHUYLER S. WHEELER,

— ON —

**Underground Arc Light Wires in New York.**

The line in 125th Street, 2,000 feet in length, is laid in the small ducts of the Johnstone system of conduits. The cable is a ***BISHOP GUTTA PERCHA WHITE CORE,*** and was laid immediately after the order for the work was given. The cable was connected to overhead arc light wires by running it up in a two-inch iron pipe fastened to the outside of an ordinary city electric lamp post. Connections were made with lights in front of stores by carrying the cable from the ducts in iron pipes under the sidewalk and up the front of the stores. This line has been in continuous use for two months, carrying a pressure of 2,500 volts, and it shows an actual rise in insulation with age and use, as will be seen from the following test:

Jan. 11th, 1,100 Megohms.
Feb. 12th, 1,800 Meghoms.
April 12th (including eight arc lamps and branch leads), 2,000 Meghoms.

*All our White Core India Rubber Insulation is Same Quality as on above cables.*

**BISHOP GUTTA PERCHA CO.,**

420-426 EAST 25TH ST., NEW YORK.

**THACKARA MANUFACTURING CO.,**

DESIGNERS AND MAKERS OF

**GAS, ELECTRIC and COMBINATION FIXTURES**

For any Incandescent System.

**Philadelphia, Pa.**

**BOOKS** ON ELECTRICAL SUBJECTS

Will be mailed to any address, postage prepaid, on receipt of price. Address,

ELECTRICAL REVIEW PUB. COMPANY,

13 Park Row, New York. P. O. Box 3,339.

## ELECTRICAL TESTING BUREAU,

JOHNS HOPKINS UNIVERSITY.

REPORT of a series of tests of the insulation resistance, capacity and conductivity of a sample covered wire sent by

**The India Rubber & Gutta Percha Insulating Co.**

**The sample submitted for measurement was 2027 ft. in length.**
**Thickness of insulation was .281 c. m.**
**Diameter of wire .1632 c. m.**

The wire was extremely flexible and was coiled and uncoiled several times before measurements were made.

The insulation consisted of several layers of India rubber, with an external cotton braiding.

The coil was immersed in water on Dec. 16 at 8.30 P. M., and tests were begun the following morning. Both the Direct and Loss of Charge methods were employed. The following are the results:

| Capacity in Microfarads per Knot. | Insulation Resistance in Megohms per Knot. | Temperature Centigrade, Degrees. | DATE. |
|---|---|---|---|
| .453 | 11240 | 8.5 | Dec. 17 |
| .441 | 9558 | 13.3 | Dec. 18 |
| .456 | 10080 | 13.0 | Dec. 19 |
| .441 | 10183 | 11.0 | Dec. 20 |
| .450 | 9620 | 10.8 | Dec. 21 |
| .450 | 10000 | 12.0 | Dec. 27 |

Direct deflection 7200 meghoms per knot at 12° C. on Dec. 27th. Conductivity was obtained by making a number of measurements of the diameter of the wire, and a determination of the resistance of the entire length of the sample at a definite temperature.

The conductivity was 98.5 per cent. that of pure copper as given by Matthiessen.

For the eleven days that the wire was in water the insulation resistance remained practically unchanged, and the slight variation which occurred can be accounted for by the difference in temperature, etc.

The insulation seems to be less affected by changes in temperature than that of other samples which we have tested at various times. Very respectfully,

[Signed] LOUIS DUNCAN,
C. A. LIEBIG, Jr.

JANUARY 5th, 1889,
WM. M. HABIRSHAW.

Westfield Mass

MANUFACTURERS OF

**Polished and Dressed Threads**

Yarns in the Grey and in all Numbers and Colors.

We make a Specialty of Threads for Covering Wires for Electrical Purposes.

*Samples Sent on Application.* *Correspondence Solicited.*

VITALIS HIMMER, Manager.

# DR. GASSNER'S DRY BATTERY

GREAT AND MERITED SUCCESS.

ADVANTAGES OVER WET BATTERIES:

Longer Length of Life. No Glass, consequently no Breakage. Easier and more Convenient to Handle. High or Low Temperature does not affect them. Invaluable for Telephone, Telegraph, Physicians, Railroads and Steamboats.

HIGHEST TESTIMONIALS.

FOR SALE AT

*The Western Electric Co., Chicago, Ill*
*and California Electrical Works, San Francisco, Cal.*

WRITE FOR CIRCULAR.

**A. SCHOVERLING,**
111 CHAMBERS STREET, N. Y.

# The Question of the Hour!

Next to the interest in the lighting of a city, the public demands rapid transit, and grasps with avidity anything calculated to enhance it.

# "THE ELECTRIC RAILWAY."

*BY FRED H. WHIPPLE,*

Is a new and original Book upon the subject, designed especially to inform the practical business man without the use of mystifying technical terms, and formulæ.

There is information in it of value to the owner, the officer and the employe of every street railway or user of power for any purpose.

**Price, Paper Cover, $1.00.**
**Bound in Flexible Russia, $2.00.**

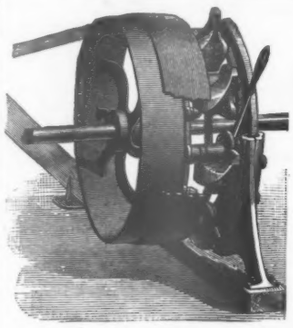
PROFUSELY ILLUSTRATED.

This Book treats of Electric Power in all its phases.

**FRED. H. WHIPPLE, DETROIT, MICH.**

Send your name, business and address, and be correctly reported in Whipple's National Electrical Directory.

**CHARLES R. VINCENT & CO.,**
15 CORTLANDT STREET, NEW YORK,
**Ball High Speed Automatic Cut-off Engines**
MANNING VERTICAL TUBULAR BOILERS,
**Complete Steam Plants Furnished and Erected.**



# THE SCHENCK Belt-Holder and Shifter Co.

INCORPORATED.

*E. P. GLEASON, President.*
*U. H. W. SCHENCK, Vice President.*
*GEO. E. LEFFINGWELL, Treasurer.*
*HOMER W. HEDGE, Secretary.*

United States, Great Britain, France, Germany Belgium and Canada.

Main Office:
**189 Mercer St., New York**

**WM. H. COLE,**
**ELECTRICAL ENGINEER,**
No. 775 TENTH AVE., NEW YORK CITY.

SPECIALTIES.—Electric Lighting, Electric Rail Roads, and power plants in connection with the same. Contractor for the construction of Electrical Machinery and Appliances. Independent, Reliable, Expert Measurements, Tests and Reports made.

THE LEHIGH VALLEY
**CREOSOTING CO.**
PERTH AMBOY, N. J.

Creosoted Lumber, Underground Conduits, Telegraph Poles, Piling and Ties Furnished.

# The Mitchell Vance Company

(SUCCESSOR TO MITCHELL, VANCE & CO.)

DESIGNERS AND MAKERS OF

ARTISTIC

# Electroliers & Combination Fixtures

FOR ANY SYSTEM OF INCANDESCENT ELECTRIC LIGHTING.

The feeling is growing that these goods should be specially adapted to the light medium; to meet this want New Designs of Artistic merit and unexcelled finish have been originated which commend themselves to intending purchasers, being shown in Parlors illuminated by Electric light.

Architects and Decorators Designs and suggestions carried out with fidelity to the given motive.

MANUFACTORY, 24th & 25th Sts. & 10th Ave.

SALESROOMS, No. 836 & 838 BROADWAY,

NEW YORK.

THE BEST

# Disque Leclanché Batteries

ARE THOSE MADE BY

**J. H. BUNNELL & CO.**

OVER 200,000 USED IN THE PAST FOUR YEARS. ALL GIVING ENTIRE SATISFACTION.

ASK ANY ONE OF THE MANY USERS OF THE SAME.

**THE REASON WHY,** is simply because our processes are the most perfect and our materials used in the manufacture are the very best selections that can be obtained.

*PRICES ALMOST, BUT NOT QUITE AS LOW AS THE RULING PRICES FOR INFERIOR MAKE.*

**Porous Cups, 35 cents, Subject to Discount in Quantity.**

ONE OF MANY: "WE ARE USING ABOUT 6,000 CELLS OF BATTERY ON OUR CIRCUITS, AND HAVE AS YET FOUND NOTHING EQUAL TO J. H. BUNNELL & CO.'S DISQUE LECLANCHE BATTERY. Yours, Resp'y, GEO. W. ADAMS, Supt., The Boston Electric Association."

**J. H. BUNNELL & CO.,**
**106 & 108 Liberty Street, NEW YORK.**
Send for our Latest Catalogue No. 6, of January, 1888.

# THE
# Westinghouse Electric Co.

LESSEE OF

# THE UNITED STATES ELECTRIC LIGHTING COMPANY.

## SPECIAL NOTICE.

THE PUBLIC are notified that from and after this date the unauthorized sale or use of DYNAMO-ELECTRIC GENERATORS AND ELECTRIC MOTORS, provided with SECTIONAL ARMATURES, built up of IRON PLATES, which are separated by interposed INSULATING MATERIAL, will be held to be in violation of

**LETTERS PATENT Nos. 401,668 AND 401,669,**

**Issued April 16, 1889, to**

## THE UNITED STATES ELECTRIC LIGHTING COMPANY,

Assignee of the Original Inventor, EDWARD WESTON, of Newark, N. J.

The claims of these patents broadly cover the CORE OF AN ELECTRIC GENERATOR subjected to inductive action, when composed of **ALTERNATE SECTIONS OF MAGNETIC AND OF INSULATING MATERIAL**, in combination with the conductors wound thereupon.

**This notice does not apply to the sellers or users of DYNAMO-ELECTRIC GENERATORS OR ELECTRIC MOTORS which embody sectional armatures manufactured by THE EDISON ELECTRIC LIGHT COMPANY, our licensee under these patents.**

All other parties are hereby warned against making, selling or using the invention covered by the above mentioned Letters Patent.

## THE WESTINGHOUSE ELECTRIC COMPANY,

**April 16th, 1889.** **GEO. WESTINGHOUSE, Jr., President.**

THE

# WESTINGHOUSE ELECTRIC CO.

PITTSBURGH, PA.

The Pioneers of Incandescent Lighting

BY

## Alternating Currents

AND OWNERS OF

*FUNDAMENTAL PATENTS PERTAINING THERETO.*

## COMPLETE CENTRAL STATION OUTFITS

**Alternating Current Apparatus,**

**Direct Current Apparatus,**

**Arc Lighting Apparatus,**

**Electric Motors,**

**Electric Meters.**

**150 Central Stations in Operation 150**

OFFICES IN ALL LEADING CITIES.

THE

# WESTINGHOUSE

ELECTRIC CO.,

PITTSBURGH, PA.

## The United States Electric Lighting Co.

[Leased and Operated by The Westinghouse Electric Co.]

SALES DEPARTMENT, 120 BROADWAY, NEW YORK.

ARC AND INCANDESCENT APPARATUS

— FOR —

## ISOLATED LIGHTING

EFFICIENT APPARATUS.
ECONOMICAL LAMPS.
INGENIOUS DEVICES.

THE

## Sawyer-Man Electric Co.

510 West 23d Street, New York.

Incandescent Electric Lamps,

— AND —

SUPPLIES FOR ELECTRIC WORK.

Electric AND Combination Fixtures.

CORRESPONDENCE WITH DEALERS INVITED.

P. and B.

FOR WEATHERPROOF QUALITIES. UNEQUALLED

# P. AND B.

BEST AND CHEAPEST

# WEATHERPROOF LINE WIRE.

POLES. CROSS ARMS, PINS, BRACKETS. INSULATORS, ETC. TOOLS.

☞ WRITE FOR SAMPLES AND QUOTATIONS. ☜

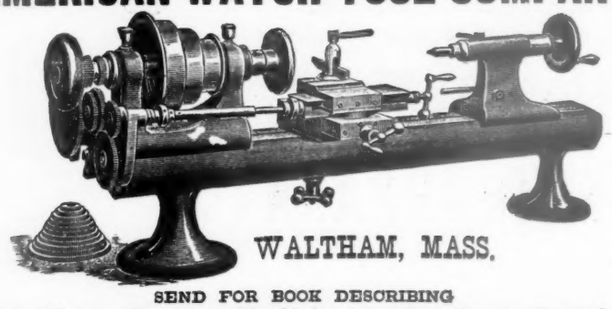
## THE ELECTRICAL SUPPLY COMPANY,

ANSONIA. CHICAGO. BRANCH OFFICE.

Factories and Eastern Office, ANSONIA, CONN. Warehouse and Western Office, 171 Randolph St., CHICAGO. 505 Delaware Street, KANSAS CITY.

EASTERN SELLING AGENTS, T. F. HUNTER & CO., 37 CHURCH STREET, NEW YORK.

## AMERICAN WATCH TOOL COMPANY



WALTHAM, MASS.

SEND FOR BOOK DESCRIBING

**Grinding, Screw Cutting, and other Special Fine Tool Making Accessories.**

## POND ENGINEERING CO.,

ENGINEERS AND CONTRACTORS.

Complete Steam Plants for Electric Light and Power.

Engines, Boilers, Furnaces, Grates, Heaters, Pumps, Injectors, Pipe Work, Belting, etc., designed with special reference to the HIGHEST EFFICIENCY.

Our Extended Experience Enables us to Guarantee Satisfaction. Send for New Illustrated Pamphlet.

ST. LOUIS, KANSAS CITY AND OMAHA.

## JARVIS ENGINEERING COMPANY,

CONTRACTING ENGINEERS for ERECTING COMPLETE STEAM PLANTS

For Electric Lighting and Power Stations.

—: AGENTS FOR :—

ARMINGTON & SIMS ENGINES,
JARVIS BOILER SETTING,
to burn Anthracite Coal and Coke Screenings,
NATIONAL FEED WATER HEATER,
NATIONAL ROCKING and
SHEFFIELD GRATE BARS.

61 OLIVER ST., BOSTON. 109 LIBERTY ST., NEW YORK. 81 LAKE ST., CHICAGO.

SEND FOR NEW CATALOGUE.

W. R. OSTRANDER & CO.
21, 23 & 25 ANN ST., NEW YORK,
Manufacturers of
SPEAKING TUBES, WHISTLES
ANNUNCIATORS,
Electric & Mechanical Bells.

FACTORY,
De Kalb Avenue,
BROOKLYN.
Send for Illustrated Catalogue.

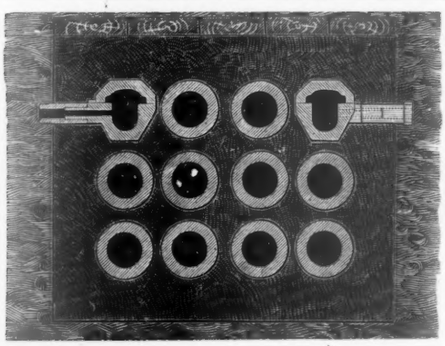
## Sperry Electric Company,

Factory, 194 to 198 So. Clinton St., Chicago, Ill.

MANUFACTURERS OF THE

Improved Sperry High and Low Tension Systems of Arc Lighting,

Claiming the Highest Efficiency, Reliability and Durability. Perfect Regulation.



C. H. JACKSON, Prest. EDWARD S. PEROT, Vice-Prest. JAS. P. MCQUAIDE, Sec'y and Treas.

## THE NATIONAL CONDUIT M'F'G COMPANY'S

# WROUGHT IRON CEMENT-LINED PIPE.

## FOR ELECTRICAL SUBWAYS.

In use by the Metropolitan Telephone and Telegraph Company of New York; by the Bell Telephone Co. of Buffalo; by the Police and Fire Departments of New York and Chicago, etc.

THIS SYSTEM IS PARTICULARLY ADAPTED FOR ELECTRIC LIGHT, TRUNK & DISTRIBUTION.

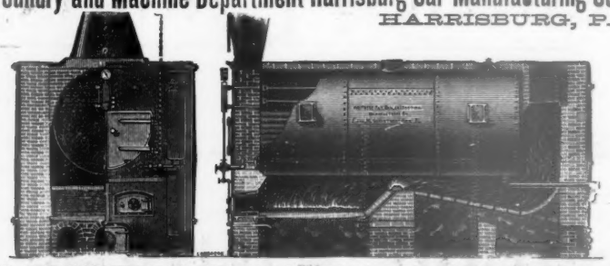
ADDRESS THE COMPANY, TELEPHONE BUILDING, NEW YORK.

## Weitmyer Patent Furnace,

MANUFACTURED AND SOLD BY

Foundry and Machine Department Harrisburg Car Manufacturing Co.

HARRISBURG, PA.



IDE AUTOMATIC ENGINE, PORTABLE & TRACTION ENGINES,

STEAM ROAD ROLLERS, BOILERS OF ALL DESCRIPTIONS.

New York Office, Messrs. Fleming & Kimball, 17 Dey Street.
New England Office, Messrs. John Post, Jr. & Co., 70 Kilby St., Boston.
Baltimore Office, Messrs. Thomas K. Carey & Bro., 26 Light St., Balt.

WESTERN OFFICE, MESSRS. ENGLISH, MORSE & CO., KANSAS CITY, MO.

## AMERICAN ELECTRICAL DIRECTORY FOR 1889

PRICE, $5.00.

The best and most permanent medium for advertisers in the electrical field.

The work reaches every electric light and power company in the country, besides telegraph and telephone companies.

This year's issue enlarged and improved.

Lists and reports of electric light and power companies, reports of National Electric Light Association, useful tables, etc., etc.

Send orders for copies of book, and for advertising space to *STAR IRON TOWER CO.*, Publishers of

American Electrical Directory, Fort Wayne, Ind.

## BOOKS ON ELECTRICAL SUBJECTS

Will be mailed to any address, postage prepaid, on receipt of price. Address,

ELECTRICAL REVIEW PUB. COMPANY,

13 Park Row, New York. P. O. Box, 3,329.

# FISHER-RAE ELECTRIC RAILWAY SYSTEM,

## *FOR STREET AND SUBURBAN TRAFFIC.*

**Embraces new and valuable improvements which are requisite to economical operation and high efficiency.**

***THE ONLY SUCCESSFUL SYSTEM USING UNDERGROUND CONDUCTORS.***

**8 MILES OF CONDUIT IN ONE ROAD AT SAN JOSE, CAL.**

### OVERHEAD CONDUCTORS.

**IMPROVED TROLLEY AND TROLLEY SUPPORT** line of neatest design. Avoids "flashing" at wheel or line contact.

### THE FISHER-RAE ELECTRIC RAILWAY SYSTEM

contains new features that will commend it to the careful attention of Street Railway Managers looking for reliable, easily operated and efficient electrical apparatus, designed to stand the test of work.

### The FISHER-RAE SYSTEM

can be placed upon existing roads without alteration of track or road-bed, and upon cars in use without interruption to traffic of road.

### POINTS OF SUPERIORITY.

**A SINGLE MOTOR GEARED TO BOTH AXLES WITH IMPROVED NOISELESS GEAR.**

**FLEXIBILITY BETWEEN MOTOR AND CAR AXLES, INSURING CLOSE MESH AND PREVENTING BREAKING FROM SUDDEN STRAINS.**

The use where desirable of a separate motor truck, making a six wheel car, securing greater comfort to passengers; motor trucks easily and quickly detachable, enabling change of motors from closed to open cars.

**CORRESPONDENCE** solicited, estimates furnished, and references given to important roads now in successful operation.

## DETROIT ELECTRICAL WORKS,

**7th and Woodbridge Streets, DETROIT, MICH.**

---

## HOLMES, BOOTH & HAYDENS,

MANUFACTURERS OF

## BARE AND INSULATED WIRE,

Underwriters' Copper Electric Light Line Wire, handsomely finished, highest conductivity. Copper Magnet Wire, Flexible Silk and Worsted Cords for Incandescent Lighting. Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

TRADE MARK "K.K."

## PATENT "K. K." LINE WIRE

TRADE MARK "K.K."

FOR ELECTRIC LIGHT, TELEGRAPH AND TELEPHONE LINES.

**Agents for the WASHINGTON CARBON CO.,**

FACTORIES: WATERBURY, CONN.

**J. L. BARCLAY, Selling Agent,**
THE ROOKERY, CHICAGO, ILL.

**NEW YORK OFFICE, 25 Park Place,**
THOS. L. SCOVILL, NEW YORK AGENT.

---

## PAILLARD NON-MAGNETIC WATCHES.

**AVOID ALL IMITATIONS.**

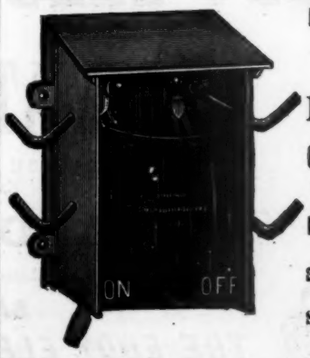
**SEE THAT "Paillard's Patent" "Balance —AND— Spring"** Is engraved on each movement

18 size full plate movement.

These Movements are of American Manufacture, and are the only American Movements made containing the Celebrated Paillard Inventions.

**The Best American Non-Magnetic Watch.**

## THE E. S. GREELEY & CO.,




**Nos. 5 & 7 Dey St., New York**

Manufacturers and Importers of and Dealers in

**Telegraph, Telephone —AND— Electric Light Supplies**

AGENTS FOR

**Cleveland Arc Light Cut Outs & Gang Switches**

Cleats, Rosettes, Moulding, Pins, Cross-Arms, Brackets. Insulating Tapes.

**Rubber, Porcelain and Glass Insulators**

**WIRES OF ALL KINDS.**

Silk & Cotton Covered Flexible Conducting Cord of various sizes for Incandescent Lighting.

Spikes, Pole Steps, Lag Screws, Drive Screws, Turn Buckles, Etc.

W. D. SARGENT, President.
E. H. UTLER, Treasurer and Manager.

JNO. A. BARRETT, Vice-President and Consulting Electrician.
FRANK A. PERRET, Electrician.

# THE ELEKTRON MANUFACTURING COMPANY

Cor. Jay and Plymouth Sts., Brooklyn, N. Y. New York Office, 150 Nassau St.

MANUFACTURERS OF

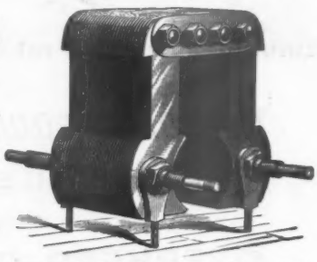
## Perret Electric Motors AND Dynamos

**SMALL SIZES A SPECIALTY.**

**1-8 TO 2 H. P.**

THE DISTINCTIVE FEATURES ARE:

LAMINATED FIELD MAGNETS,
LOW ARMATURE RESISTANCE,
NO SPARKING UNDER CHANGES OF LOAD,
EXCELLENT WORKMANSHIP.



Laminated Field Magnets, by the use of which higher efficiency is obtained than is possible otherwise.

In Efficiency, Regulation, Simplicity and Durability our Machines Show Great Superiority.
Careful Investigation Invited. Catalogues Furnished on Application.

# Sprague Electric Railway and Motor Company.

## THE NEW SPRAGUE ELECTRIC MOTOR TRUCK.

DETAILS OF TRUCK:

**Flexible Suspension, Noiseless Gearing, All Bearings Self-Oiling and Dust-Proof, Brushes of a New Design, and Perfection as regards Ease of Running. All Parts Completely Incased and Protected from Dust. All Bearings independently Removable. Every Part Designed to be readily Accessible, and to Reduce all Necessary Attendance and Care to a Minimum.**

FOR CIRCULARS AND FULL INFORMATION, ADDRESS

**Sprague Electric Railway and Motor Co., 16 & 18 Broad Street, N. Y.**

# DAFT ELECTRIC LIGHT COMPANY,

**Executive Offices, 115 BROADWAY, New York.**

# Electric Railways and Power Stations,

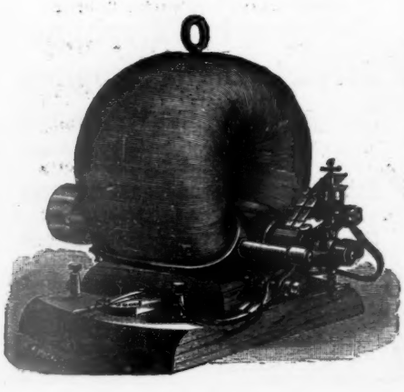
**STATIONARY MOTORS, STORAGE BATTERIES,**

**DYNAMOS, 1 to 250 H. P. MOTORS, ½ to 100 H. P.**

WORKS, JERSEY CITY, N. J.

# THE EDDY ELECTRIC M'F'G CO.

MANUFACTURERS OF



## AUTOMATIC ELECTRIC MOTORS,

In all sizes, from 1-2 H. P. upward; High Efficiency; Perfect Regulation; Superior Workmanship; Ease of Management; Remarkable Simplicity, etc., etc.

## DYNAMO ELECTRIC MACHINES,

For Electro-Plating, Electrotyping, Copper Refining, Etc. No Reversing. No Water. No Noise. No Spark.

**SATISFACTION GUARANTEED.**

*THE EDDY ELECTRIC M'F'G CO., WINDSOR, CONN.*

**NEW YORK, 115 Broadway, BOSTON, 620 Atlantic Ave.,
PHILADELPHIA, 506 Commerce Street.**

M. T. Greene, President. Geo. A. McKinlock, Treasurer. Wm. H. McKinlock, Secretary.

# Central Electric Company,

GENERAL WESTERN AGENTS OKONITE WIRE AND CABLES,

OKONITE TRADE MARK.

## Candee Weatherproof Electric Light Line Wire

ABSOLUTELY THE BEST.

A COMPLETE STOCK OF GENERAL ELECTRIC SUPPLIES ALWAYS ON HAND. SHIPMENTS PROMPT.

CENTRAL ELECTRIC COMPANY, 42 LA SALLE STREET, CHICAGO, ILL.

---

WILLIAMS & POTTER,
15 CORTLANDT ST., NEW YORK.
Engineers & Contractors,
GENERAL AGENTS,
STRAIGHT LINE ENGINES

---

THE
American Bell Telephone Company,
95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30, 1877, No. 186,787.

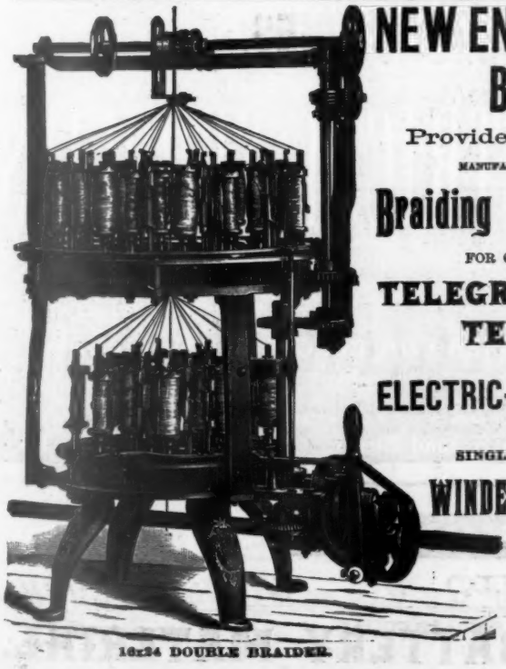
The Transmission of Speech by all known forms of ELECTRIC SPEAKING TELEPHONES infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof and liable to suit therefor.

---

SUNLIGHT CARBONS

The PARKER-RUSSELL MINING & M'F'G CO,
ROOMS, 200 and 202
AMERICAN CENTRAL BUILDING,
ST. LOUIS.
UNIFORM IN QUALITY, LONG LIFE AND GOOD LIGHT.

---



16x24 DOUBLE BRAIDER.

NEW ENGLAND BUTT CO.,
Providence, R. I.,
MANUFACTURERS OF
Braiding Machinery
FOR COVERING
TELEGRAPH, TELEPHONE AND ELECTRIC-LIGHT WIRE
ALSO
SINGLE AND DOUBLE
WINDERS AND BRAIDERS
Of every Description for Silk, Worsted and Cotton Braid.
FINE CASTINGS A SPECIALTY

---

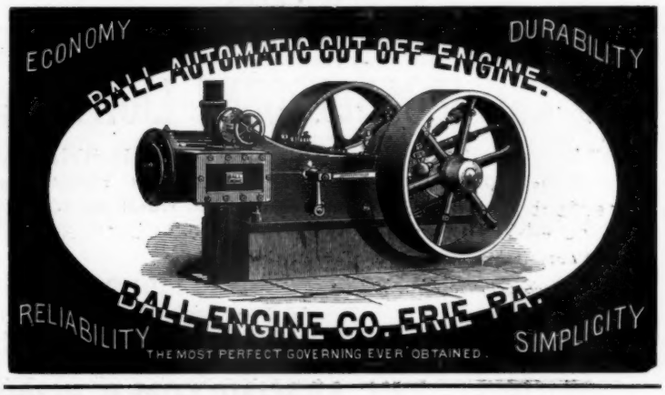
OUR NEW LOCATION.

ANNOUNCEMENT.

"Centennial Day," April 30th, 1889, being a legal holiday, our factory will not be run, but we shall have our works open for inspection all day. We extend an invitation to our friends, customers and others interested to give us a call on that day, and inspect our plant at our new location—
Laight and Canal Streets.

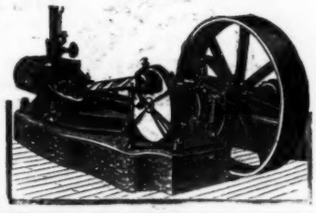
E. E. GARVIN & CO.

---




---

Russell & Co.
MASSILLON, OHIO,
BUILDERS OF
AUTOMATIC ENGINES
BOILERS, ETC.
Complete Power Plants Furnished and Erected.
SEND FOR CATALOGUE.



---

VAN DEPOELE ELECTRIC MFG CO.
MANUFACTURERS OF
ARC & INCANDESCENT ELECTRIC LIGHT APPARATUS & SUPPLIES, OF ALL KINDS
OFFICE & WORKS
15, 17, 19 & 21 NORTH CLINTON ST.
CHICAGO.

# BELL HANGERS' HAND BOOK

BY F. B. BADT.

106 Pages, 97 Illustrations, Flexible Cloth Binding, Type Pages 5½ x 3 inches.

PRICE ONE DOLLAR.

Just the Book for those engaged in Selling, Installing or Handling Electric Batteries, Electric Bells, Elevator, House or Hotel Annunciators, Burglar or Fire Alarm, Electric Gas Lighting Apparatus, Electric Heat Regulating Apparatus, Etc.. Etc.

THE ONLY BOOK OF THE KIND PUBLISHED.

FIRST EDITION TWENTY-FIVE HUNDRED COPIES. SENT, POSTAGE FREE, ON RECEIPT OF PRICE.

**Western Electric Company, 227 South Clinton Street, Chicago.**

AND 70 TRINITY PLACE, NEW YORK.

---

**ROYCE & MAREAN,**
DEALERS IN
**ELECTRICAL APPARATUS**
Telegraph and Telephone Supplies,
No. 1408 Penna. Avenue,
Opp. Willard's Hotel. WASHINGTON. D. C.

BALL AUTOMATIC CUT OFF ENGINE
MADE ONLY BY
THE BALL ENGINE CO ERIE PA.
Eastern Agents. C. R. Vincent & Co., Room 16 15 Cortlandt Street, New York.

---

THE STREET RAILWAY JOURNAL

Vol. V. 113 Liberty St., New York. Monthly, $2.00 Per Year.

ESTABLISHED 1884.
E. P. HARRIS, Editor and Manager,
113 Liberty Street, NEW YORK.

CONTENTS.
Each Issue has 120 Pages or more Valuable matter—80 pages per issue.
A Directory of Street Railways in the United States and Canada.
A Directory of Manufacturers of street railway appliances and materials.

Is the Best Advertising Medium through which to reach Street Railways.

---

Ball Electric Light Co.,
18 CORTLANDT ST. NEW YORK

MANUFACTURERS
The Celebrated BALL DYNAMOS and LAMPS
— FOR —
ARC AND INCANDESCENT LIGHTING.

This System is **mechanically** and **electrically** perfect and produces a steady, white and noiseless light with the minimum of expense, both as to the power required and the cost of repairs.

*For descriptive Circulars or Testimonials, address*

FACTORY: 9th Ave. & 27th St., New York City.
BALL ELECTRIC LIGHT CO., 18 Cortlandt St., N. Y. City.

---

**WANTED.**

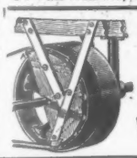
I have clients who will purchase second hand Arc and Incandescent Dynamos, Lamps, Sockets and accessories.

W. H. COLE,
Electrical Engineer,
502 West 53d St.,
New York City.

---

**THE TRENTON ENGINE.**
AUTOMATIC CUT-OFF,
BALANCE VALVE,
POSITIVE EXHAUST.
ECONOMY, DURABILITY AND CLOSE REGULATION GUARANTEED.
PHŒNIX IRON CO., Trenton, N. J., B'ldrs
F. Van Winkle, 91 Liberty St. N.Y. Agent.

---



WELLINGTON
**Belt Holder**
The simplest, cheapest and handiest device in existence for shifting Dynamo Belts. Please write for circulars to
W. R. SANTLEY & CO.
WELLINGTON, O.

---

THE NATIONAL
**GALVANIC BATTERY**

UNEQUALED FOR
BELLS, TELEPHONES, GAS LIGHTING, ETC.
PLATINUM CARBON CONNECTION.
PERFORATED BODY.
The only real improvement of a POROUS CUP.
NO SOAKING REQUIRED.
ALWAYS WORKS INSTANTLY,
WILL LAST A LIFE TIME.
SIMPLE, CLEAN, DURABLE.
Write for circulars & prices.
*THE NATIONAL GALVANIC BATTERY CO.*
241 Main St., CINCINNATI, O
18 Cortlandt St., NEW YORK.

---

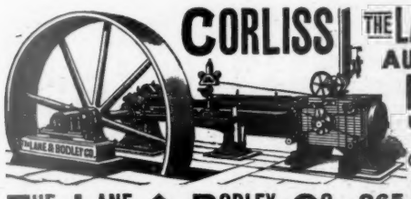
J. E. JEFFORDS & CO.,
Manufacturers to the Trade.
POROUS CELLS
Of Every Description, Made to Order.
25 years' experience in this branch of the business.
2716 to 2738 Salmon St., Philadelphia, Pa.

---

ARMINGTON & SIMS ENGINE COMPANY — TRADE MARK — PROVIDENCE, R.I. U.S.A.

**THE ARMINGTON & SIMS**
Automatic Cut-off Engine,
FOR ALL PURPOSES WHERE POWER IS REQUIRED.
CLOSE REGULATION,
ECONOMICAL OF FUEL,
SMALL SPACE REQUIRED,
MODERATE PRICE,
OVER 2,500 ENGINES IN USE.
— SEND FOR CIRCULAR. —

---



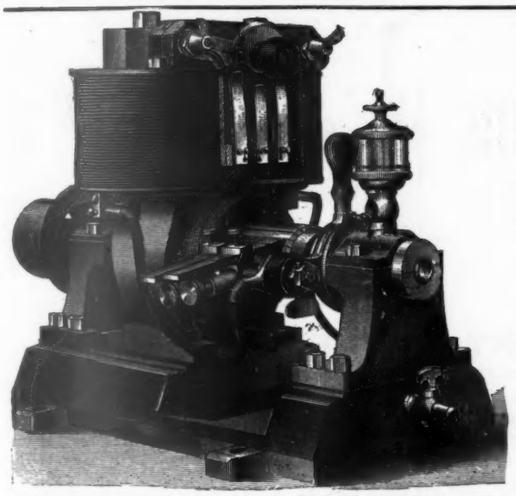
CORLISS | THE LANE & BODLEY CO.
AUTOMATIC CUT OFF
ENGINES
Unrivalled for Strength, Durability and Close Regulation.
CONSTRUCTION OF COMPLETE PLANTS A SPECIALTY.
THE LANE & BODLEY CO., 265 to 271 WATER ST., CINCINNATI, O.

---

FRANKLIN S. CARTER. CHAS. M. WILKINS. E. WARD WILKINS.
ESTABLISHED 1867.
PARTRICK & CARTER,
MANUFACTURERS OF AND DEALERS IN EVERY DESCRIPTION OF
ELECTRICAL SUPPLIES.
SOLE PROPRIETORS OF THE
PATENT NEEDLE ANNUNCIATORS AND BURGLAR ALARMS.
WE MAKE A SPECIALTY OF
BELLS, DISQUE LECLANCHE BATTERIES, GAS-LIGHTING APPARATUS
AND A FULL LINE OF
SUPPLIES FOR ELECTRIC BELL WORK.
We publish Catalogues of all our Manufactures, and will forward to any address upon application.
N.B. When applying for Catalogues, please state whether "Electric Bell" or "General Supply" Catalogue is wanted, and if in the trade inclose business card for discounts.
114 South Second Street. PHILADELPHIA, PA.

---

THE NATIONAL CARBON CO.
CLEVELAND, OHIO.
MANUFACTURERS OF
ELECTRIC LIGHT CARBONS AND BATTERY MATERIAL.



# "C. & C." ELECTRIC MOTOR CO.

402 & 404 Greenwich St., New York.

## EFFICIENT ELECTRIC MOTORS,

MANUFACTURED FOR ARC AND INCANDESCENT CIRCUITS.

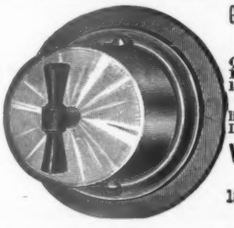
## AUTOMATICALLY REGULATED

NEW ENGLAND OFFICE, 32 OLIVER ST., BOSTON.
WESTERN OFFICE, 139 & 141 ADAMS ST., CHICAGO.
SOUTHERN OFFICE, 25 CARONDELET ST., NEW ORLEANS.
PHILADELPHIA OFFICE. 301 ARCH STREET.

## Forest City Electric Works

MANUFACTURERS OF

Cleveland's Electric Light Cut-outs

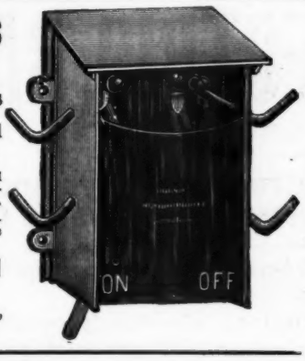


Gang Switches from 5 to 40 Amperes.

Quick make and Break uncontrolled by the Handle.

Correspondence Solicited with Electric Light Companies.

W.B. Cleveland
PROPRIETOR,
183 Seneca Street,
CLEVELAND, O.




## BELL HANGERS' HAND BOOK

By F. B. BADT.

106 Pages, 97 Illustrations. Price, ONE DOLLAR

Just the Book for those engaged in Selling, Installing or Handling Electric Batteries, Electric Bells, Elevator, House or Hotel Annunciators, Burglar or Fire Alarms, Electric Gas Lighting Apparatus, Electric Heat Regulating Apparatus, Etc., Etc.

THE ONLY BOOK OF THE KIND PUBLISHED.

ELECTRICAL REVIEW,

Sent, postage free, on receipt of price. 31 Park Row, N. Y.

## THE "MONUMENTAL" MAGNETO BELL.

For use with Acoustic Telephones and for general signal purposes. Works well on lines up to three or four miles in length.

Send for Descriptive Circular With Prices.

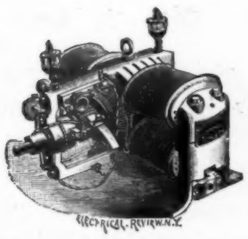
Magneto and Extension Bells,
Hand and Power Generators of all Sizes.

Electrical Supplies of ALL KINDS manufactured and sold at the lowest prices.

VIADUCT MANUFACTURING CO.,
BALTIMORE, MD.

# EDCO SYSTEM

Dynamos, Motors, Batteries,



Voltmeters, Ammeters, Switches,

AND

## Complete Electric Light and Power Plants

FOR

Towns, Offices, Residences, Factories, Theatres, Etc.

## Street Cars Equipped For Electric Propulsion.

The oldest and most experienced Electric Motor Co. in the world.

# The Electro-Dynamic Co.

OF PHILADELPHIA,

Main Office, 224 Carter Street, Philadelphia, Pa.

New York Office, 44 Broadway.

# Fort Wayne Jenney Electric Light Company,

## FORT WAYNE, IND.

**The most carefully worked out and Complete Alternating System of Electric Lighting in existence. Armatures and Converters guaranteed. 12-16 candle-power Lamps to the mechanical horse power guaranteed.**

MANUFACTURERS OF THE

**SLATTERY INDUCTION SYSTEM**

OF

**Incandescent Lighting**

AND THE

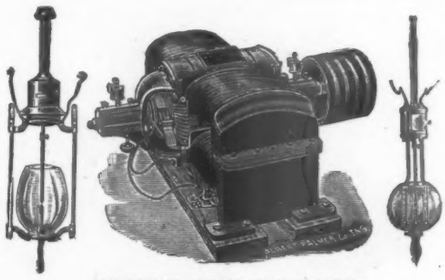
**Original Jenney System**

OF

**ARC LIGHTING.**

SLATTERY DYNAMO, LAMP AND CONVERTER.

**CORRESPONDENCE SOLICITED.**



JENNEY DYNAMO AND LAMPS.

**MAIN OFFICE AND WORKS, FORT WAYNE, IND.**

New York Office, Room 45, 115 Broadway. Manhattan Electric Light Co., 511 Broadway, Sole Licensees and Agents for New York City and Brooklyn.

CHICAGO OFFICE, 185 Dearborn St., *W. J. BUCKLEY, Manager.*

PHILADELPHIA OFFICE, 907 Filbert St., *G. A. WILBUR, Manager.*

SAN FRANCISCO OFFICE, 217 Sansome St.

F. ADAM SUC'S; CITY OF MEXICO.

# BENTLEY-KNIGHT ELECTRIC RAILWAY CO.,

## 25 & 27 TENTH AVE., NEW YORK.

**Contractors for the Construction of City Street Railways and Surburban Tramways using either Underground, Surface or Elevated Conductors.**

ESTIMATES FURNISHED ON APPLICATION.

N. B.—The Bentley-Knight Electric Railway Company absolutely controls all efficient and economic methods of operating electrically-equipped cars by means of conductors contained in and protected by sub-surface conduits. Entering the field long in advance of all others, it first encountered the many difficulties which had to be met and overcome; and the many patents now owned and controlled by it effectually cover each and every detail (both mechanical and electrical) necessary to the successful construction and operation of an electrical railway in a city street.

# ELECTRICAL CONTRACT WORK.

Detailed Estimates made and Contracts taken for

EQUIPMENT OF COMPLETE

**Steam and Electrical Plants**

OF

ANY SYSTEM

OF

**ARC AND INCANDESCENT LIGHTING,**

**CENTRAL STATIONS,**

And ELECTRIC STREET RAILWAYS, operated overhead, underground or by storage batteries.

Address,

EUGENE T. LYNCH, Jr., Consulting Engineer,
120 BROADWAY, NEW YORK.

GRIMSHAW WHITE CORE INSULATED WIRE

**Grimshaw Patented White Core WIRES and CABLES.**

*FIRE, ACID, AND WATERPROOF. GRIMSHAW TAPE.*

NEW YORK INSULATED WIRE Co.,

R. E. GALLAHER, Secretary. J. W. GODFREY, Gen'l Manager. W. B. DOWSE, Treasurer.

Sole Manufacturers,
649 & 951 BROADWAY, N. Y.

# THOMSON-HOUSTON ELECTRIC CO.,

MANUFACTURERS OF

**DYNAMOS**

FOR

**ARC & INCANDESCENT LIGHTING,**

**MOTORS**

FOR STATIONARY OR RAILWAY USE.

**THOMSON-HOUSTON ELECTRIC CO.,**

620 Atlantic Avenue, Boston, Mass.